Project Manual

For

Schroeder Elementary School
HVAC Upgrade & Modernization

15151 Columbia Ln. Huntington Beach, CA 92647

VOLUME 1 and 2

Bidding and Contract Requirements
And
Specifications

for the

Westminster School District
14121 Cedarwood St. Westminter, CA 92683

Date: 11/14/2025

PBK Project No.: 250376

Project Manual

for:

Schroeder Elementary School
HVAC Upgrade & Modernization

for the

Westminster School District

Date: 11/14/2025

PBK Project No.: 250376

Consultants:

Architect:
PBK
2400 East Katella
Suite 950
Anaheim, CA 92806
Phone: (949) 548-5000

Structural:
VCA Engineers Inc.
631 S. Atlantic Blvd.
Monterey park, CA 91754

Phone: (323) 729-6098

Electrical:
LEAF Engineers
8163 Rochester Ave.
Suite 100
Rancho Cucamonga, CA 91730
Phone: (909) 390-3111

Mechanical:
LEAF Engineers
8163 Rochester Ave.
Suite 100
Rancho Cucamonga, CA 91730
Phone: (909) 390-3111

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 04-124972 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 03/17/2026

DOCUMENT 00 01 10 TABLE OF CONTENTS

VOLUME 1 DISTRICT DOCUMENTS

DIVISION 00 BIDDING AND CONTRACT REQUIREMENTS

00 00 00 Project Manual Cover and Seals
00 01 10 Table of Contents

DIVISION 1 GENERAL REQUIREMENTS

01 25 00 Substitution Procedures and Form
01 26 00 Contract Modification Procedures
01 31 00 Project Management and Coordination
01 32 00 Construction Progress Documentation
01 33 00 Submittal Procedures
01 40 00 Quality Requiremetns
01 45 23 Testing and Inspecting Services
01 50 00 Temporary Facilities and Controls
01 60 00 Product Requirements
01 73 29 Cutting and Patching
01 74 19 Construction Waste Management and Disposal
01 77 00 Closeout Procedures

PROJECT SPECIFICATIONS - Volume 2

DIVISION 2 EXISTING CONDITIONS

02 21 00 Surveys
02 41 00 Demolition
02 41 13 Selective Site Demolition
02 41 19 Selective Demolition

DIVISION 3 CONCRETE

03 10 00 Concrete Forming and Accessories
03 15 00 Concrete Accessories
03 20 00 Concrete Reinforcing
03 30 00 Cast-in-Place Concrete
03 35 00 Concrete Finishing
03 35 43 Polished Concrete Finishing
03 35 47 Concrete Floor Slab Moisture Vapor Control System
03 53 00 Concrete Topping

DIVISION 5 METALS

05 12 00 Structural Steel Framing
05 50 00 Metal Fabrications

DIVISION 6 WOOD, PLASTICS, AND COMPOSITES

06 10 00 Rough Carpentry
06 10 53 Miscellaneous Rough Carpentry
06 16 00 Sheathing
06 20 00 Finish Carpentry and Millwork
06 40 00 Architectural Woodwork

DIVISION 7 THERMAL AND MOISTURE PROTECTION

07 51 00	Built-Up Bituminous Roofing
07 62 00	Sheet Metal Flashing and Trim
07 72 00	Roof Accessories
07 72 33	Roof Hatches
07 72 36	Smoke Vents
07 92 00	Joint Sealants

DIVISION 8 OPENINGS

08 11 13	Hollow Metal Doors and Frames
08 14 16	Flush Wood Doors
08 71 00	Door Hardware

DIVISION 9 FINISHES

09 29 00	Gypsum Board
09 30 00	Tiling
09 51 00	Acoustical Ceiling Panels
09 65 13.13	Resilient Base
09 65 43	Linoleum Flooring
09 68 00	Carpeting
09 68 01	Carpeting Walk-Off Mats
09 90 00	Painting and Coating

DIVISION 10 SPECIALTIES

10 11 00	Markerboard and Tackboard
10 14 00	Graphics and Signage
10 21 13	Toilet Compartments
10 28 13	Toilet Accessories
10 44 00	Fire Extinguisher and Cabinets

DIVISION 22 PLUMBING

22 00 00	General Plumbing Provisions
22 00 01	Plumbing

DIVISION 23 MECHANICAL

23 00 00	General Mechanical Provisions
23 00 01	Heating Ventilating and Air Conditioning
23 09 23	Direct Digital Controls

DIVISION 26 ELECTRICAL

26 05 00	Common Work Results for Electrical
26 05 01	Selective Electrical Demolition
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceway and Boxes for Electrical Systems
26 05 53	Identification of Electrical Systems
26 20 00	Electrical Distribution Equipment
26 27 26	Wiring Devices
26 51 00	Interior Lighting

DIVISION 28 ELECTRONIC SAFETY AND SECURITY

28 31 00 Fire Detection and Alarm

DIVISION 31 EARTHWORK

31 22 00 Grading
31 23 23 Fill

DIVISION 32 EXTERIOR IMPROVEMENTS

32 01 13 Rolled Slurry Existing Pavement
32 01 17 Asphalt Pavement Repair
32 12 16 Asphalt Paving
32 16 00 Site Concrete
32 17 13 Parking Bumpers
32 17 23 Pavement Markings

END OF SECTION 00 01 10

SECTION 01 25 00 SUBSTITUTION PROCEDURES AND FORM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

A. Products: Items purchased for incorporation in the Work, regardless if specifically purchased for the Project or taken from Contractor's previously purchased stock. The term *product* is inclusive for material, equipment, assembly, system, and other terms of similar intent.

B. Substitutions:
   1. Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor:
      a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
      b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

A. Substitution Requests:
   1. Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles:
      a. Substitution Request Form: Use facsimile of form provided in Project manual.
      b. Documentation:
         1) Show compliance with requirements for substitutions and the following, as applicable:
            a) Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
            b) Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, which are necessary to accommodate proposed substitution.
            c) Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
            d) Product Data, including drawings and descriptions of products and fabrication and installation procedures.
            e) Samples, where applicable or requested.

f) Certificates and qualification data, where applicable or requested.
g) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i) Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j) Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k) Cost information, including a proposal of change, if any, in the Contract Sum.
l) Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m) Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action:
   a. If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later:
      1) Forms of acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
      2) Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

B. Coordination: Revise or adjust affected Work as necessary to integrate Work of the approved substitutions.

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions: Substitutions are considered as changes to the Drawings and shall be submitted to DSA.

B. Substitutions for Cause:
   1. Submit requests for substitution immediately on discovery of need for change, but not later than 30 days prior to time required for preparation and review of related submittals:
      a. Conditions:
         1) Architect will consider Contractor's request for substitution when the following

conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a) Requested substitution is consistent with the Contract Documents and will produce indicated results.
b) Substitution request is fully documented and properly submitted.
c) Requested substitution will not adversely affect Contractor's Construction Schedule.
d) Requested substitution has received necessary approvals of authorities having jurisdiction.
e) Requested substitution is compatible with other portions of the Work.
f) Requested substitution has been coordinated with other portions of the Work.
g) Requested substitution provides specified warranty.
h) If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitutions for Convenience:
1. Architect will consider requests for substitution if received prior to the Award of the Contract. Requests received after that time may be considered or rejected at discretion of Architect:
a. Conditions:
1) Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
a) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b) Requested substitution does not require extensive revisions to the Contract Documents.
c) Requested substitution is consistent with the Contract Documents and will produce indicated results.
d) Substitution request is fully documented and properly submitted.
e) Requested substitution will not adversely affect Contractor's Construction Schedule.
f) Requested substitution has received necessary approvals of authorities having jurisdiction.
g) Requested substitution is compatible with other portions of the Work.
h) Requested substitution has been coordinated with other portions of the Work.
i) Requested substitution provides specified warranty.
j) If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 EXECUTION (NOT USED)

REQUEST FOR SUBSTITUTION

Contract Award Date:
_____

To:
_____

Substitution Requested By:
_____

Project Name and Number:
_____

We submit for consideration the following product in lieu of the specified item for the above Project:

Drawing No.	Specification Section	Paragraph	Specified Item
_____	_____	_____	_____

Proposed Substitution:
_____

Request is made during ____ bidding _____ construction period.

Submit in accordance with Section 01 33 00: Submittal Procedures.

1. Technical data, cost, and time information relating to changes to Construction Documents required by proposed substitution.
2. Detailed comparison of proposed substitution and specified product including but not limited to warranty, significant variations, qualifications of manufacturers, and maintenance.
3. Complete technical data, detailed shop drawings, samples, installation procedures, warranty, and substantiating data marked to indicate equivalent quality and performance to that specified. Manufacturer sell sheets are not acceptable submittals.

Cause for Request:
_____

Cost saving realized by Owner:
_____

Does substitution affect adjacent Work, Construction Documents, cost, schedule, quality, and related submittals?

Yes _____ No ____ On separate sheet, explain affects to the Work, documents, schedule, and submittals.

Contractor is responsible for associated costs and additional time of the proposed substitution including costs incurred by the Architect for evaluation of substitution and changes to the documents. Describe costs for changes to design, including engineering and detailing costs caused by the requested substitution.
_____

_____

Warranty: Is the warranty for the requested substitution the same or different? Yes ____No ____

Explain Differences:
_____

Contractor Certification:

In making a request for substitution, Contractor certifies that:

1. The proposed substitution has been thoroughly researched and evaluated and determined as equivalent or superior to specified product or material, will fit into space provided, and is compatible with adjacent materials.
2. It will provide the same or better warranty for the proposed substitution at no additional cost to the Owner.
3. Cost data is complete and includes related costs under the Contract. Claims for additional costs related to the proposed substitution that may subsequently become apparent are waived.
4. It will assume the responsibility for delays and costs caused by the proposed substitution, if approved, are accepted by Contractor unless delays are and costs are specifically mentioned and approved in writing by the Owner and the Architect.
5. It will assume the liability for the performance of the substitution and its performance.
6. The installation of the proposed substitution is coordinated with the Work and with changes required for the Work.
7. It will reimburse the Owner and Architect for evaluation and redesign services associated with the substitution request and, when required, by approval by governing authorities.

____ Has the substituted manufacturer/product been installed on previous PBK projects?

If so, list project(s): (List projects within the last two years)

1. _____

   District: _____

   Contact:_____

2. _____

   District_____

   Contact:

   _____

Submitted by:

_____

Signature of Contractor Title

_____

Firm Telephone Date

Signature shall be by the individual authorized to legally bind Contractor to the above terms. Failure to provide legally binding signature will result in retraction of approval.

FOR USE BY ARCHITECT:

____ Accepted ____ Accepted as Noted
____ Not Accepted ____ Received Too Late

By: _____

Date: _____

Remarks: _____

FOR USE BY OWNER:

____ Accepted ____ Not Accepted

By: _____

By: _____

Remarks: _____

END OF SECTION 01 25 00

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Section:
   1. Section 01 25 00: Substitution Procedures and Form.

C. Minor Changes in the Work:
   1. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 *Architect's Supplemental Instructions*.

1.3 PROPOSAL REQUESTS

A. Owner Initiated Proposal Requests:
   1. Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications:
      a. Work Change Proposal Requests issued by Architect are not instructions either to stop Work in progress or to execute the proposed change.
      b. Within time specified in Proposal Request after receipt of Proposal Request, submit quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change:
         1) Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
         2) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
         3) Include costs of labor and supervision directly attributable to the change.
         4) Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor Initiated Proposals:
   1. If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect:
      a. Include statement outlining reasons for the change and the effect of the change on the Work. Provide complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
      b. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade

discounts.

d. Include costs of labor and supervision directly attributable to the change.
e. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
f. Comply with requirements in Section 01 25 00: Substitution Procedures and Form if the proposed change requires substitution of one product or system for product or system specified.
g. Proposal Request Form: Use AIA Document G709.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive:
   1. Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order:
      a. Construction Change Directive contains a complete description of change in the Work and designates the method to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of Work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 26 00

SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
      a. General coordination procedures.
      b. Coordination drawings.
      c. Pre-installation meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. Requests for Information (RFI) will not be allowed from Sub-Contractors. The Contractor is to evaluate the Sub-Contractor's request and respond if the Contractor deems necessary the RFI will be forwarded to the Architect for a evaluation and response. The Contractor shall arrange the necessary meeting in the field with appropriate Architect's field representative(s) to obtain clarification as needed on items that may need interpretation, clarification and respond appropriately.

1.3 SUBMITTALS

A. Subcontract List:
   1. Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
      a. Name, address, and telephone number of entity performing subcontract or supplying products.
      b. Number and title of related Specification Section(s) covered by subcontract.
      c. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names:
   1. Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and the duties and responsibilities; list address, telephone numbers (home, office, and cellular), and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project:
      a. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 COORDINATION PROCEDURES

A. Coordinate construction operations to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper

installation, connection, and operation:

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

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

C. Administrative Procedures:
   1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Administrative activities include, but are not limited to, the following:
      a. Preparation of Contractor's Construction Schedule.
      b. Preparation of the schedule of values.
      c. Installation and removal of temporary facilities and controls.
      d. Delivery and processing of submittals.
      e. Progress meetings.
      f. Pre-installation conferences.
      g. Project closeout activities.
      h. Startup and adjustment of systems.
      i. Coordinating inspections and other jurisdictional requirements.
      j. Coordinate OFCI equipment.
      k. Action items and issue logs.

D. Conservation:
   1. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste:
      a. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to the Specifications Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General:
   1. Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on shop drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity:
      a. Content:
         1) Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
            a) Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
            b) Coordinate the addition of trade specific information to the coordination drawings by multiple contractors in sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

c) Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d) Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e) Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f) Indicate required installation sequences.
g) Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization:
1. Floor plans and reflected ceiling plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan Drawings with section drawings where required to adequately represent the Work.
2. Plenum space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures, ductwork, piping, and other components.
3. Mechanical rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire-alarm, and electrical equipment.
4. Structural penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab edge and embedded items: Indicate slab edge locations and sizes, and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and plumbing work - Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts, and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical work - Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   e. Floor boxes.
8. Fire protection system - Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, sprinkler heads, and inspector test locations.
9. IDF/MDF rooms: Communications and low voltage (security, data, phone, etc.) audio.
10. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
11. Coordination drawing prints: Prepare coordination drawing prints according to

requirements in Section 01 33 00: Submittal Procedures.

C. Coordination Digital Data Files:
1. Prepare coordination digital data files according to the following requirements:
a. File preparation format: Same digital data software program, version, and operating system as original Drawings.
b. File submittal format: Submit or post coordination drawing files using same format as file preparation.
c. BIM file incorporation:
1) Develop and incorporate coordination drawing files into Building Information Model established for Project:
a) Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
d. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files:
1) Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
2) Digital data software program: Drawings are available in Revit.
3) Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated:
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Architect to prepare the meeting agenda and distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
4. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
5. Issue logs: Documentation element of software project management and contains a list of ongoing and closed issues of the Project.

B. Kick-off and Preconstruction Conference:
1. Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect:
a. Conduct the conference to review responsibilities and personnel assignments.
b. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
c. Agenda: Discuss items of significance that affect progress.
d. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
e. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

C. Pre-Installation Conferences:
   1. Conduct a pre-installation trade conference at site before each construction activity that requires coordination with other construction trades:
      a. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Engineer of Record of scheduled meeting dates.
      b. Agenda: Contractor to review progress of other construction activities and preparations for the particular activity under consideration.
      c. Contractor to record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
      d. Reporting: Contractor to distribute minutes of the meeting to each party present and to other parties requiring information.
      e. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
      f. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

D. Project Closeout Conference:
   1. Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion:
      a. Conduct the conference to review requirements and responsibilities related to Substantial Completion.
      b. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
      c. Agenda: Discuss items of significance that could affect or delay Project closeout.
      d. Minutes: Entity conducting meeting will record and distribute meeting minutes.
      e. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

E. Progress Meetings:
   1. Conduct progress meetings at weekly intervals:
      a. Coordinate dates of meetings with preparation of payment requests.
      b. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
      c. Agenda:
         1) Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project:
            a) Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      d. Minutes:

1) Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information:
   a) Schedule updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
   b) Six (6) week look-ahead schedules. This may be altered to three (3) week look-ahead as part of an action item when Architect/District request:
      i. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

F. Coordination Meetings:
   1. Conduct coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences:
      a. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with the Project and authorized to conclude matters relating to the Work.
      b. Agenda:
         1) Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project:
            a) Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
            b) Schedule updating: Revise combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
            c) Review present and future needs of each contractor present.
      c. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
      d. Action items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's Construction Schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Special reports.

1.3 DEFINITIONS

A. Activity:
   1. A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources:
      a. Critical activity: An activity on the critical path that must start and finish on the planned early start and finish times.
      b. Predecessor activity: An activity that precedes another activity in the network.
      c. Successor activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Float:
   1. The measure of leeway in starting and completing an activity:
      a. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
      b. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
      c. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Look-ahead Schedule: Schedule indicating activities scheduled to occur or commence prior

to submittal of next schedule update.

G. Milestones: Measurable, observable, and serve as progress markers (flags) but, by definition, are independent of time (have zero durations); therefore, no Work or consumption of resources is associated with them.

H. Recovery Schedule: Submittal of a revised CPM schedule and a written plan.

I. Resource Loading: The allocation of manpower and equipment necessary for completion of an activity as scheduled.

1.4 SUBMITTALS

A. Submittal Format:
   1. Submit required submittals in the following format:
      a. Working electronic copy of schedule file, where indicated.
      b. PDF electronic file.

B. Startup Diagram: Of size necessary to display entire network for entire construction period. Show logic relationship ties for all activities.

C. Contractor's Construction Schedule:
   1. Initial schedule, of size required to display entire schedule for entire construction period:
      a. Submit a working electronic copy of schedule labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports:
   1. Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days:
      a. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
      b. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
      c. Total Float Report: List of all activities sorted in ascending order of total float.
      d. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at monthly intervals.

G. Material Location Reports: Submit at monthly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Pre-Scheduling Conference:
   1. Conduct conference at site. Review methods and procedures related to the preliminary

construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
a. Review software limitations and content and format for reports.
b. Verify availability of qualified personnel needed to develop and update schedule.
c. Discuss constraints, including phasing, Work stages, area separations, interim milestones, and partial Owner occupancy.
d. Review delivery dates for Owner furnished products.
e. Review schedule for work of Owner's separate contracts, if any.
f. Review submittal requirements and procedures.
g. Review time required for review of submittals and resubmittals.
h. Review requirements for tests and inspections by independent testing and inspecting agencies.
i. Review time required for Project closeout and Owner startup procedures.
j. Review and finalize list of construction activities to be included in schedule.
k. Review procedures for updating schedule.

B. Coordination:
1. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports:
a. Secure time commitments for performing critical elements of the Work from entities involved.
b. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Time is of the essence to Owner. Commence Work immediately upon issuance of the Notice to Proceed. There is a critical need for the Work to be substantially complete within the time frame identified in the Agreement.

B. Time Frame:
1. Extend schedule from date established for commencement of the Work to date of Substantial Completion and date of final completion:
a. Contract completion date shall not be changed by submission of schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities:
1. Treat each separate area or story as a separate numbered activity for each main element of the Work. Comply with the following:
a. Activity duration: Define activities in terms of number of days anticipated.
b. Procurement activities: Include procurement process activities for long lead items and major items requiring a cycle of more than 60 days as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
c. Submittal review time: Include review and resubmittal times indicated in Section 01 33 00: Submittal Procedures in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
d. Startup and testing time: Include number of days anticipated for startup and testing.
e. Substantial Completion: Indicate completion of all conditions as in advance of date

established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

f. Punch list and final completion: Include a maximum of 30 days for completion of punch list items and final completion.

g. Inspections required by Authorities Having Jurisdiction (AHJ).

D. Constraints:

1. Include constraints and Work restrictions indicated in the Contract Documents and show how the sequence of the Work is affected:
   a. Work restrictions:
      1) Show the effect of the following items on the schedule:
         a) Coordination with existing construction.
         b) Limitations of continued occupancies.
         c) Uninterruptible services.
         d) Partial occupancy before Substantial Completion.
         e) Use of premises restrictions.
         f) Provisions for future construction.
         g) Seasonal variations.
         h) Environmental control.
         i) Rain days as indicated in Section 01 10 00: Summary.
   b. Work stages:
      1) Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
         a) Submittals.
         b) Mockups.
         c) Fabrication.
         d) Installation.
         e) Tests and inspections.
         f) Adjusting.
         g) Curing.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

F. Six (6) Week Look-Ahead Schedule:

1. Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   a. Unresolved issues.
   b. Unanswered Requests for Information.
   c. Rejected or unreturned submittals.
   d. Notations on returned submittals.
   e. Pending modifications affecting the Work and Contract Time.
   f. Inspections by AHJ.
   g. Trade pre-installation conference.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

I. Contract Modifications: For each proposed Contract modification and concurrent with its

submission, prepare a time impact analysis to demonstrate the effect of the proposed change on the overall Project schedule.

J. Schedule Updating:
1. Concurrent with making revisions to the schedule, prepare tabulated reports showing the following:
   a. Identification of activities that have changed.
   b. Changes in early and late start dates.
   c. Changes in early and late finish dates.
   d. Changes in activity durations in workdays.
   e. Changes in the critical path.
   f. Changes in total float or slack time.
   g. Changes in Contract Time.

3.2 REPORTS

A. Daily Construction Reports:
1. Prepare a daily construction report recording information concerning events at the site and submit each month to Architect:
   a. List of subcontractors at the Project site.
   b. List of separate contractors at the Project site.
   c. Approximate count of personnel at the Project site.
   d. Rental equipment at the Project site.
   e. Material deliveries.
   f. High and low temperatures and general weather conditions, including presence of rain or snow.
   g. Accidents.
   h. Meetings and significant decisions.
   i. Unusual events (see special reports).
   j. Stoppages, delays, shortages, and losses.
   k. Meter readings and similar recordings.
   l. Emergency procedures.
   m. Orders and requests of AHJ.
   n. Change Orders received and implemented.
   o. Construction Change Directives received and implemented.
   p. Services connected and disconnected.
   q. Equipment or system tests and startups.
   r. Partial completions and occupancies.
   s. Substantial Completions authorized.

B. Material Location Reports:
1. At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from the Project site. Indicate the following categories for stored materials:
   a. Material stored prior to previous report and remaining in storage.
   b. Material stored prior to previous report and since removed from storage and installed.
   c. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report and contact Architect's field representative. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents to Architect's field representative.

D. Special Reports:
   1. Submit special reports directly to Owner within 24 hours of an occurrence. Distribute copies of report to parties affected by the occurrence:
      a. Reporting unusual events: When an event of an unusual and significant nature occurs at site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner and Architect in advance when these events are known or predictable.

3.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating:
   1. At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule with a pencil copy of pay application:
      a. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
      b. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
      c. As the Work progresses, indicate final completion percentage for each activity.

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

END OF SECTION 01 32 00

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Requirements for the submittal schedule and administrative and procedural requirements for submitting shop drawings, product data, samples, and other submittals.

1.3 DEFINITIONS

A. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

B. Portable Document Format (PDF): An open standard file format used for representing documents in a device and display resolution independent fixed layout document format.

C. Submittals: Written and graphic information and physical samples that require Architect's responsive action, or are for information and do not require Architect’s action.

1.4 SUBMITTALS

A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections:
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's Construction Schedule.
   2. Initial submittal: Submit concurrently with construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files:
   1. Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals:
      a. Upon request, Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing shop drawings and Project record drawings:

1) Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
2) Digital drawing software program: The Contract Drawings are available in Revit.
3) Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
4) The following digital data files will by furnished for each appropriate discipline:
   a) Floor plans.
   b) Reflected ceiling plans.

B. Coordination:
   1. Coordinate preparation and processing of submittals with performance of construction activities:
      a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
      b. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
      c. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
      d. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination:
         1) Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time:
   1. Allow time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals:
      a. Initial review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
      b. Intermediate review: If intermediate submittal is necessary, process in same manner as initial submittal.
      c. Resubmittal review: Allow 15 days for review of each resubmittal.
      d. Sequential review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
      e. Concurrent consultant review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals:
   1. Identify and incorporate information in each electronic submittal file:
      a. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
      b. Name file with submittal number or other unique identifier, including revision identifier:
         1) File name shall use Project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., SLOHSM-06 10 00.01). Resubmittals shall include an alphabetic suffix after another

decimal point (e.g., SLOHSM-06 10 00.01.A).

c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
d. Transmittal form for electronic submittals:
    1) Use software generated form from electronic project management software acceptable to Owner**,** containing the following information:
        a) Project name.
        b) Date.
        c) Name and address of Architect.
        d) Name of Construction Manager.
        e) Name of Contractor.
        f) Name of firm or entity that prepared submittal.
        g) Names of Subcontractor, manufacturer, and supplier.
        h) Category and type of submittal.
        i) Submittal purpose and description.
        j) Specification Section number and title.
        k) Specification paragraph number or Drawing designation and generic name for each of multiple items.
        l) Drawing number and detail references, as appropriate.
        m) Location(s) where product is to be installed, as appropriate.
        n) Related physical samples submitted directly.
        o) Indication of full or partial submittal.
        p) Transmittal number, numbered consecutively.
        q) Submittal and transmittal distribution record.
        r) Other necessary identification.
        s) Remarks.
e. Metadata:
    1) Include the following information as keywords in the electronic submittal file metadata:
        a) Project name.
        b) Number and title of appropriate Specification Section.
        c) Manufacturer name.
        d) Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals:
1. Make resubmittals in same form and number of copies as initial submittal:
    a. Note date and content of previous submittal.
    b. Note date and content of revision in label or title block and clearly indicate extent of revision.
    c. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

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

I. Use for Construction: Retain complete copies of submittals on the Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. Submittal Procedure Requirements:
1. Prepare and submit submittals required by individual Specification Sections:
a. Submit electronic submittals via email as PDF electronic files:
1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
b. Submittals: Submit three (3) paper copies of each submittal unless otherwise indicated. Architect will return two (2) copies.
c. Certificates and certifications submittals:
1) Provide statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity:
a) Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
b) Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data:
1. Collect information into a single submittal for each element of construction and type of product or equipment:
a. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as shop drawings, not as product data.
b. Mark each copy of each submittal to show which products and options are applicable.
c. Include the following information, as applicable:
1) Manufacturer's catalog cuts.
2) Manufacturer's product specifications.
3) Standard color charts.
4) Statement of compliance with specified referenced standards.
5) Testing by recognized testing agency.
6) Application of testing agency labels and seals.
7) Notation of coordination requirements.
8) Availability and delivery time information.
d. For equipment, include the following in addition to the above, as applicable:
1) Wiring diagrams showing factory installed wiring.
2) Printed performance curves.
3) Operational range diagrams.
4) Clearances required to other construction, if not indicated on accompanying shop drawings.
e. Submit product data before or concurrent with samples.
f. Submit product data in PDF electronic file.

C. Shop Drawings:
1. Prepare Project specific information, drawn accurately to scale. Do not base shop drawings on reproductions of the Contract Documents or standard printed data:
a. Preparation:
1) Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
a) Identification of products.
b) Schedules.
c) Compliance with specified standards.
d) Notation of coordination requirements.
e) Notation of dimensions established by field measurement.

f) Relationship and attachment to adjoining construction clearly indicated.
g) Seal and signature of professional Engineer if specified.

b. Sheet size: Except for templates, patterns, and similar full-size drawings, submit shop drawings on sheets size indicated in Specification Section.
c. Submit shop drawings in PDF electronic file.

D. Samples:
1. Submit samples for review of kind, color, pattern, and texture for a check of characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed:
   a. Transmit samples that contain multiple related components, such as accessories, together in one submittal package.
   b. Identification:
      1) Attach label on unexposed side of samples that includes the following:
         a) Generic description of sample.
         b) Product name and name of manufacturer.
         c) Sample source.
         d) Number and title of applicable Specification Section.
         e) Specification paragraph number and generic name of each item.
   c. For projects where electronic submittals are required, provide corresponding electronic submittal of sample transmittal, digital image file illustrating sample characteristics, and identification information for record:
      1) Disposition: Maintain sets of approved samples at the Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      2) Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such samples must be in an undamaged condition at time of use.
      3) Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   d. Submit full size units or samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following:
      1) Partial sections of manufactured or fabricated components.
      2) Small cuts or containers of materials.
      3) Complete units of repetitively used materials.
      4) Swatches showing color, texture, and pattern.
      5) Color range sets.
      6) Components used for independent testing and inspection:
         a) Number of samples - Submit three (3) sets of samples. Architect will retain two (2) sample sets; remainder will be returned:
            i. Submit a single sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
            ii. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a sample, submit at least three (3) sets of paired units that show approximate limits of variations.

E. Product Schedule:
1. As required in individual Specification Section, prepare a written summary indicating types of products required for the Work and their intended locations. Include the following information in tabular form:
   a. Type of product. Include unique identifier for each product indicated in the Contract

Documents or assigned by Contractor if none is indicated.
b. Manufacturer, product name, and model number if applicable.
c. Number and name of room or space.
d. Location within room or space.
e. Submit product schedule in PDF electronic file.

F. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00: Payment Procedures.

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 45 23: Testing and Inspecting Services.

H. Closeout Submittals required for Substantial Completion: Comply with requirements specified in Section 01 77 00: Closeout Procedures.

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

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

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

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

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

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

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

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

Q. Research Reports:
1. Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with the building code in effect for the Project. Include the following information:
a. Name of evaluation organization.
b. Date of evaluation.
c. Time period when report is in effect.
d. Product and manufacturers' names.

e. Description of product.
f. Test procedures and results.
g. Limitations of use.

R. Pre-Construction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product for compliance with performance requirements in the Contract Documents.

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

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location for compliance with requirements in the Contract Documents.

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

2.2 DELEGATED DESIGN SERVICES

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

B. Delegated Design Services Certification:
1. In addition to shop drawings, product data, and required submittals, submit digitally signed PDF electronic file and three (3) paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional:
a. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

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

3.2 ARCHITECT'S ACTION

A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
   1. Reviewed: Indicates the Architect has reviewed the submittal and takes no exceptions as submitted.
   2. Furnish as Corrected: Submittal is approved, provided modifications noted are properly incorporated. Resubmission is not usually necessary.
   3. Revised and Resubmit: Modifications are required prior to approval. Work cannot proceed until the submittal is revised and resubmitted for further review.
   4. Rejected: Work covered by the submittal is not complete or does not conform the contract documents and cannot proceed. A new submittal needs to be made according to the notations and resubmitted for approval prior to fabrication or construction.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

C. Incomplete submittals are not permitted, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents will be returned by Architect without action.

END OF SECTION 01 33 00

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated and paid by the District (or refer to Section 01 45 23: Testing and Inspecting Services). These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements:
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
   4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, experienced means having successfully completed a minimum of five (5) years' documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality Control Testing: Tests and inspections performed onsite for installation of the Work and for completed Work.

C. Installer/Applicator/Erector:
   1. Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations:
      a. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

D. Mockups:
   1. Full size physical assemblies that are constructed onsite. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will

be judged:

a. Laboratory mockups: Full size physical assemblies constructed at testing facility to verify performance characteristics.
b. Integrated exterior mockups: Mockups of exterior envelope erected separately from the building but on the Project site, consisting of multiple products, assemblies, and subassemblies.
c. Room mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

E. Pre-Construction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

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

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

H. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include Contract enforcement activities performed by Architect.

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

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

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two (2) or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.5 SUBMITTALS

A. Shop Drawings:
1. Submit Plans, Sections, and elevations, indicating materials and size of mockup construction:
a. Indicate manufacturer and model number of individual components.
b. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Contractor's Statement of Responsibility:
   1. When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
      a. Seismic force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by Architect.
      b. Main wind force resisting system or wind resisting component listed in the wind force resisting system quality assurance plan prepared by Architect.

C. Schedule of Tests and Inspections:
   1. Prepare in tabular form and include the following:
      a. Specification Section number and title.
      b. Entity responsible for performing tests and inspections.
      c. Description of test and inspection.
      d. Identification of applicable standards.
      e. Identification of test and inspection methods.
      f. Number of tests and inspections required.
      g. Time schedule or time span for tests and inspections.
      h. Requirements for obtaining samples.
      i. Unique characteristics of each quality control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports:
   1. Prepare and submit certified written reports specified. Include the following:
      a. Date of issue.
      b. Project title and number.
      c. Name, address, and telephone number of testing agency.
      d. Dates and locations of samples and tests or inspections.
      e. Names of individuals making tests and inspections.
      f. Description of the Work and test and inspection method.
      g. Identification of product and Specification Section.
      h. Complete test or inspection data.
      i. Test and inspection results and an interpretation of test results.
      j. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
      k. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
      l. Name and signature of laboratory inspector.
      m. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports:
   1. Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
      a. Name, address, and telephone number of technical representative making report.
      b. Statement on condition of substrates and their acceptability for installation of product.
      c. Statement that products at site comply with requirements.
      d. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
      e. Results of operational and other tests and a statement of whether observed performance complies with requirements.
      f. Statement whether conditions, products, and installation will affect warranty.
      g. Other required items indicated in individual Specification Sections.

C. Factory Authorized Service Representative's Reports:

1. Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified in other Sections. Include the following:
   a. Name, address, and telephone number of factory authorized service representative making report.
   b. Statement that equipment complies with requirements.
   c. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   d. Statement whether conditions, products, and installation will affect warranty.
   e. Other required items indicated in individual Specification Sections.

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

E. Trade Pre-Installation Conferences: Meeting minutes to be Contractor provided.

1.7 QUALITY ASSURANCE

A. Qualifications establish the minimum qualification levels required; refer to individual Specification Sections for additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated and sufficient production capacity to produce required units.

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

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

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

F. Specialists:
   1. Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated:
      a. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing Agency Qualifications:
   1. A NRTL, a NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E329; with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities:
      a. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
      b. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of the manufacturer who is trained and approved by the manufacturer to observe and inspect installation of the manufacturer's products.

I. Factory Authorized Service Representative Qualifications: An authorized representative of the manufacturer who is trained and approved by the manufacturer to inspect installation of the manufacturer's products.

J. Pre-Construction Testing:
   1. Where testing agency is indicated to perform pre-construction testing for compliance with specified requirements for performance and test methods, comply with the following:
      a. Contractor responsibilities include the following:
         1) Provide test specimens representative of proposed products and construction.
         2) Submit specimens with sufficient time for testing and analyzing results to prevent delaying the Work.
         3) Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
         4) Build site assembled test assemblies and mockups using installers who will perform same tasks for the Project.
         5) Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
         6) When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on the Project.
   2. Testing agency responsibilities: Submit certified written report of each test, inspection, and similar quality assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups:
   1. Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
      a. Build mockups in location and of size indicated, or if not indicated, as directed by Architect.
      b. Notify Architect a minimum of seven (7) days in advance of dates and times when mockups will be constructed.
      c. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction.
      d. Demonstrate the proposed range of aesthetic effects and workmanship.
      e. Obtain Architect's approval of mockups before starting Work, fabrication, or construction. Allow seven (7) days for initial review and each re-review of each mockup.
      f. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      g. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Mockup of the exterior envelope erected separately from the building but on the Project site, consisting of multiple products, assemblies, and subassemblies. Mockup, if not specifically shown on the Drawings, shall be minimum eight feet by eight feet (8’x8’). Mockup shall include all major façade elements and at least one (1) window a minimum of two feet by two feet (2’x2’) in size. Prior to constructing mockup, verify requirements with Architect. Pre-installation conferences for trades involved in integrated exterior mockup shall be held after mockup is completed.

M. Laboratory Mockups: Comply with requirements of pre-construction testing and those specified in individual Specification Sections.

N. Trade Pre-Installation Conferences: Meeting minutes to be Contractor provided.

1.8 QUALITY CONTROL

A. Owner Responsibilities:
   1. Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services:
      a. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
      b. Costs for retesting and re-inspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities:
   1. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not:
      a. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
      b. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
      c. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
      d. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
      e. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
      f. Submit additional copies of each written report directly to authorities having jurisdiction when they so direct.
      g. Provide documentation for construction safety as required by CBC Chapter 33 and CFC Chapter 33. Show representation for construction safeguards through the life of the Project.

C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00: Submittal Procedures.

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of installer activities, inspection of completed portions of the Work, and submittal of written reports.

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

F. Testing Agency Responsibilities:

1. Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections:
    a. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
    b. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
    c. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
    d. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
    e. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
    f. Do not perform any duties of Contractor.

G. Associated Services:
1. Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
    a. Access to the Work.
    b. Incidental labor and facilities necessary to facilitate tests and inspections.
    c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
    d. Facilities for storage and field curing of test samples.
    e. Delivery of samples to testing agencies.
    f. Preliminary design mix proposed for use for material mixes that require control by testing agency.
    g. Security and protection for samples and for testing and inspecting equipment at the Project site.

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

I. Schedule of Tests and Inspections:
1. Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses:
    a. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections:
1. Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections, as required by authorities having jurisdiction, as the responsibility of Owner, and as indicated in individual Specification Sections:
    a. Verifying that manufacturer maintains detailed fabrication and quality control procedures, and reviews the completeness and adequacy of those procedures to perform the Work.
    b. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
    c. Submitting a certified written report of each test, inspection, and similar quality

control service to Architect with copy to Contractor and to authorities having jurisdiction.

d. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
e. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
f. Retesting and re-inspecting corrected Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log:
   1. Prepare a record of tests and inspections. Include the following:
      a. Date test or inspection was conducted.
      b. Description of the Work tested or inspected.
      c. Date test or inspection results were transmitted to Architect.
      d. Identification of testing agency or special inspector conducting test or inspection.

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

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes:
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29: Cutting and Patching.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 40 00

SECTION 01 45 23 TESTING AND INSPECTING SERVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements and qualifications including but not limited to:
   1. Professional testing and laboratory services.
   2. Accessories necessary for the completion of testing and laboratory services.

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

C. A Qualified Independent Testing Laboratory and/or Geotechnical Engineering Service Selected and Paid by Owner:
   1. Owner will pay for the initial laboratory services of materials that comply with the requirements of the Contract Documents. Contractor shall pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents.

D. Inspecting agency shall perform inspections and tests in accordance with the rules and regulations of the building code, local authorities, specifications of ASTM, and the Contract Documents.

E. Materials and workmanship found not in compliance with required standards or performance obligations shall be removed and replaced. Replacement and subsequent testing shall be at Contractor’s expense.

F. Where terms “Inspector” and “Laboratory” are used, it is meant and in reference to an officially designated and accredited inspector of the testing laboratory or geotechnical service engaged by Owner.

G. Laboratory inspections shall not relieve Contractor or fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

H. Contractor or fabricator shall cooperate with the testing laboratory in matters pertaining to the Work.

I. Contractor to address deficiency and failed reports.

1.3 SUBMITTALS

A. Schedule of Tests and Inspections:
   1. Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses:
      a. Prepare in tabular form and include the following:
         1) Specification Section number and title.
         2) Entity responsible for performing test and inspection.
         3) Description of test and inspection.
         4) Identification of applicable standards.
         5) Identification of test and inspection methods.
         6) Number of tests and inspections required.
         7) Time schedule or time span for tests and inspections.
         8) Requirements for obtaining samples.
         9) Unique characteristics of each quality control service.

B. Test and Inspection Reports:
   1. Prepare and submit certified written reports specified. Include the following:
      a. Date of issue.
      b. Project title and number.
      c. Name, address, and telephone number of testing agency.
      d. Dates and locations of samples and tests or inspections.
      e. Names of individuals making tests and inspections.
      f. Description of the Work and test and inspection method.
      g. Identification of product and Specification Section.
      h. Complete test or inspection data.
      i. Test and inspection results and an interpretation of test results.
      j. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
      k. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
      l. Name and signature of laboratory inspector.
      m. Recommendations on retesting and re-inspecting.

C. Submit copies of reports of each inspection and test:
   1. Owner, program or project manager, Architect, and each engineer or outside consultants regarding their particular phase of the Project: One (1) copy each.
   2. Construction Manager (CM) and Contractor: Two (2) copies each.

D. In addition to furnishing a written report, notify the CM and Contractor verbally of uncorrected conditions or failures to comply with requirements of the Contract Documents, and immediately fax and email corresponding report to Architect and the engineer.

E. At completion of each trade or branch of Work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of Work.

F. Report full compliance with requirements of the Contract Documents.

G. Submit copies of test results sealed by a registered engineer to municipal authorities having jurisdiction, as required.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. The 2022 California Administrative Code (Title 24, Part 2, Volume 2) describes the general administrative requirements for the Project under the jurisdiction of the Division of the State Architect (DSA). Included is a list of inspections coordinated with CBC Section listings. These provisions require that a structural test for construction projects under DSA jurisdiction be performed by testing laboratories acceptable to DSA. DSA administers the Laboratory Evaluation and Acceptance Program to evaluate laboratories for structural testing and special inspection services. A NRTL, a NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E329 and ASTM E534, and with additional qualifications specified in individual Sections:
    a. NRTL: A Nationally Recognized Testing Laboratory according to 29 CFR 1910.7.
    b. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
    c. Laboratory Evaluation and Acceptance program to evaluate laboratories acceptable to DSA.
    d. Testing agencies shall be insured against errors and omissions by a professional liability insurance policy having a minimum limit of liability of $500,000.00.

B. Inspection and testing services for the testing agency shall be under the direction of a California Registered Engineer, charged with engineering managerial responsibility, and having a minimum of five (5) years' engineering experience in inspection and testing of construction materials.

C. Concrete Inspectors: Inspecting personnel monitoring concrete work shall be ACI certified inspectors.

D. Structural Steel:
1. Primary inspectors performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, *Standard and Guide for Qualification and Certification of Welding Inspectors*:
    a. Inspector may be supported by assistant inspectors who perform specific inspection functions under the direct supervision of the primary inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). Work of assistant inspectors shall be monitored daily by the inspector.

E. Testing Equipment: Equipment shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards.

F. Referenced Standards: Latest adopted edition of standards referenced apply to the Work. In the event of conflict between the Contract Documents and referenced standards, the Contract Documents shall govern. In case of conflict between Contract Documents and the California Building Code, the more stringent shall govern.

G. Owner Responsibilities:
1. Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services:
    a. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
    b. Costs for retesting and re-inspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

H. Contractor Responsibilities:
1. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies

with requirements, whether specified or not:

a. Refer to individual Specification Sections for specific requirements.
b. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
c. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
d. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
e. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
f. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
g. Submit additional copies of each written report directly to authorities having jurisdiction when they so direct.
h. Associated responsibilities and services - Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel:
    1) Provide the following:
        a) Provide access to the Work.
        b) Deliver of samples to testing laboratory, without cost to Owner, in adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
        c) Advise laboratory and Architect sufficiently in advance of construction operations to allow laboratory to complete required inspections or tests and to assign personnel for field inspection and testing as specified.
        d) Provide facilities for storage and curing of concrete test samples on site for the first 24 hours and for subsequent field curing required by ASTM C31.
        e) Incidental labor, facilities, and equipment necessary to assist laboratory personnel in obtaining and handling samples at the site.
        f) Preliminary design mix proposed for use for material mixes that require control by testing agency.
        g) Provide concrete mix designs in accordance with ACI 301 made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, select and pay for laboratory.
        h) Obtain required inspections or approvals of the building official. Inspection requests and notifications required by building code are responsibility of Contractor.
        i) Provide current welder certificates for each welder employed.
        j) Provide fabrication and erection inspection and testing of welds in accordance with AWS D1.1, Chapter 6.
        k) Use prequalification of welding procedures in executing the Work.
        l) Security and protection for samples and for testing and inspecting equipment at the Project site.
i. Retesting/re-inspecting: Regardless of payment responsibility of the original tests or inspections, provide quality control services, including retesting and re-inspecting, for construction that replaced Work failing to comply with the Contract Documents, code requirements, or what is required from DSA.

I. Testing Agency Responsibilities:
    1. Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections:

a. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
b. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
c. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
d. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
e. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
f. Do not perform any duties of Contractor.

J. Authority and Duties of Laboratory Personnel:
1. A representative of the testing laboratory, who has reviewed and is familiar with the Project and Specifications, shall participate in pre-construction conferences. The representative shall coordinate material testing and inspection requirements with Contractor and its subcontractors consistent with the planned construction schedule. The laboratory representative shall attend conferences required or requested to address quality control issues.
2. Laboratory personnel shall inspect and test materials, assemblies, specimens, and Work performed, including design mixes, methods and techniques, and report the progress to Architect.
3. If material or Work fails to meet requirements of the Contract Documents, the laboratory inspector shall notify the CM, Architect, engineers, supplier, or Subcontractor providing or preparing the materials or Work being tested of such failure.
4. Laboratory personnel shall not perform the work of Contractor or act as foremen or superintendents. Work will be inspected as it progresses, but failure to detect defective Work or materials shall not prevent later rejection when a defect is discovered.
5. Laboratory personnel are not authorized to revoke, alter, relax, enlarge, or release the requirements of the Contract Documents or approve or accept portions of Work, except where approval is specifically specified in the Specifications.
6. Comply with building code requirements for special inspections.

K. Testing Laboratory Guidelines and Procedures:
1. Technicians scheduled to perform specific testing services must be qualified to review and perform other services that overlap, i.e. earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the site.
2. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for hours over eight (8) hours spent at the site on a single day, field testing services performed on a Saturday or Sunday, and field services performed on a recognized holiday.
3. There shall be a three (3) hour minimum for each scheduled testing service. Vehicle charges will be included on a $25.00 per trip basis.
4. Cylinder pick up will be controlled by the technician performing test on a scheduled pick up day. If there are no testing services scheduled, the cylinder pick up fee is $40.00 on week days and $50.00 on weekends and holidays with no technician or vehicle charge.
5. Contractor shall bear the responsibility of scheduling the testing services. Contractor and the testing laboratory shall assume full responsibility to coordinate the testing services. Cancellations or failed test shall be reimbursable to the Owner by the responsible party for the cancellations or failure of a test or service.

L. Coordination:
1. Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting:

a. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log:
   1. Prepare a record of tests and inspections. Include the following:
      a. Date test or inspection was conducted.
      b. Description of the Work tested or inspected.
      c. Date test or inspection results were transmitted to Architect.
      d. Identification of testing agency or special inspector conducting test or inspection.
      e. Deficiency log.

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

3.2 TESTING AND INSPECTION SERVICES

A. Testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain Specification compliance and which may be deemed necessary by Architect, the engineer, or Owner to ensure the quality of the Work.

B. Owner reserves the right to add to or delete any or all inspection and testing specified, excluding testing required by the applicable building codes.

C. If conflicts arise between Drawings and Specifications, notify Architect immediately. The most stringent requirements shall dictate procedure.

3.3 TESTING OF EARTHWORK

A. Testing Services (as specified or required):
   1. References (as applicable for tests required):
      a. American Society for Testing and Materials (ASTM):
         1) D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3).
         2) D2922 - Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth).
         3) D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
      b. American Association of State Highway and Transportation Officials (AASHTO):
         1) T89 - Determining the Liquid Limit of Soils.
         2) T90 - Determining the Plastic Limit and Plasticity Index of Soils.
         3) T99 - Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305-mm (12-in) Drop.
         4) T238 - Density of Soil and Soil Aggregates In Place By Nuclear Methods (Shallow Depth).
   2. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab on grade, and backfills.
   3. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.

4. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
5. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material,
6. Perform one (1) in place density test for each 2,500 square feet (280 square yards) of existing subgrade material.
7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one type of fill material. If the original choice of material does not meet the Specifications, Contractor shall pay for additional testing.
8. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one test for each 2,500 square feet (280 square yards) of each lift of compacted fill.
9. Perform testing at a frequency of one (1) in-place density and moisture test for each 75 lineal feet or less of utility trench, with a minimum of three (3) tests per lift

B. Reports:
   1. Submit reports with the following information:
      a. Type and condition of soil at footing bottoms.
      b. Level of water table in the excavated areas.
      c. Grain size distribution of fill materials (average of three [3] tests).
      d. Moisture density test results.
      e. In place density test results with moisture content and relative density of each layer of compacted fill. Include with in place density test results, a plan showing location of each test.
      f. Notify Architect by telephone within one (1) hour of the discovery of the following conditions and follow up telephone notification with written report:
         1) Materials used or degree of soil compaction not meeting specified requirements.
         2) Frost and freeze protection requirements for excavation bottoms not being complied with.
         3) Water in excavations not being removed prior to Work being performed in excavation.

3.4 INSPECTION OF PIPED SITE UTILITIES

A. Laboratory representative shall observe and report on the following:
   1. Proper alignment and grade of trenches.
   2. Pipe bedding and supports.
   3. Pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
   4. Installation of pipe and joints.
   5. Testing of piped utilities performed by Contractor.

3.5 PAVING

A. Testing Services:
   1. Perform field tests for moisture density properties:
      a. Provide field testing of the subgrade as specified.
      b. Paving sub-base: Provide one (1) field test for every 5,000 square feet of area of crushed limestone or caliche sub-base.
      c. Lime treated subgrade: Provide one (1) field test for every 5,000 square feet of area of lime treated subgrade for content of lime and subgrade compaction.
      d. Cement soil stabilization: Provide one (1) field test for every 5,000 square feet of area of cement stabilized subgrade for content of cement and subgrade compaction.

3.6 PIER DRILLING OPERATION

A. A representative of a qualified geotechnical laboratory shall provide services specified.

B. Laboratory representative shall make continuous inspections to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before placing concrete.

C. Laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, volume of concrete used, and deviations from specified tolerances.

D. Laboratory representative shall make continuous inspections of drilled pier construction to check the following:
1. Verify soundness of bearing stratum and desired penetration.
2. Verify pier dimensions and reinforcing used.
3. Monitor condition of hole and removal of water and loose material from bottom.
4. Monitor placement of concrete and use of tremie or pumps.
5. Monitor the extraction of casing, if used.

E. Request probe holes when deemed necessary to confirm safe bearing capacity.

3.7 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspect concrete reinforcing steel prior to placing concrete for compliance with Contract Documents and approved shop drawings. Noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of Contractor for correction and, if left uncorrected, reported to Architect.

B. Laboratory representative shall observe and report on the following:
1. Number and size of bars.
2. Bending and lengths of bars.
3. Splicing.
4. Clearance to forms, including chair heights.
5. Clearance to sides and bottom of trench if soil formed.
6. Clearance between bars or spacing.
7. Rust, form oil, and other contamination.
8. Grade of steel.
9. Securing, tying, and chairing of bars.
10. Excessive congestion of reinforcing steel.
11. Installation of anchor bolts and placement of concrete around such bolts.
12. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
13. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360-degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

C. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three (3) years of experience inspecting reinforcing steel in projects of similar size.

3.8 CONCRETE INSPECTION AND TESTING

A. Receive and evaluate proposed concrete mix designs submitted by Contractor. If mix designs comply with Drawings and Specifications, the laboratory shall submit a letter to the Architect certifying compliance. Mix designs not complying with Drawings and Specifications shall be returned by the laboratory as being unacceptable. Check the proposed mixes for proportions, water cement ratio, and slump in accordance with ACI 613 and 318.

B. Comply with ACI 311 *Guide For Concrete Inspection* and ACI *Manual of Concrete Inspection*.

C. Sample and test concrete placed at the site in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis.

D. Test concrete:
   1. Mold and cure five (5) specimens from each sample:
      a. For each 50 cubic yards or fraction thereof of structural building concrete.
      b. For each 100 cubic yards or fraction thereof of nonstructural concrete and site Work paving and sidewalks.
      c. Laboratory cure two (2) cylinders in accordance with ASTM C192.
      d. Field cure remaining cylinders in accordance with ASTM C31.
   2. Two (2) specimens shall be tested at seven (7) days for information, two (2) shall be tested at 28 days for acceptance.
   3. Store one (1) cylinder for testing at 56 days in the event the 28-day strength tests do not meet strength requirements.

E. Deviations from the requirements of ASTM specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C39.

F. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.

G. Supervise curing and protection provided for test specimens in field and transportation from the field to laboratory. Test cylinders shall be stored in the field for 24 hours and then carefully transported to laboratory and cured in accordance with ASTM C31.

H. Make one (1) strength test (four [4] cylinders) of each mix design of concrete placed in any one (1) day.

I. Make one (1) slump test for each set of cylinders following procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever consistency of concrete appears to vary. Slump tests corresponding to samples from which strength tests are made shall be reported with strength test results. Other slump tests need not be reported.

J. Determine total air content of air entrained normal weight concrete sample for each strength test in accordance with ASTM C231.

K. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.

L. Determine temperature of concrete sample for each strength test.

M. Inspect each batch of concrete and monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing form mixers before mix begins to set and within time limits set forth in ASTM C94:
   1. Monitor addition of water and high range water reducer to concrete at job site and

length of time concrete is allowed to remain in truck during placement.

N. Testing agency shall furnish and maintain a competent inspector at the mixing plant at the start of each day's mixing. Inspector shall examine concrete materials for compliance with Specifications and approved mix design, weighing and measuring devices, proportioning and mixing of materials, water and cement content of each batch, general operation of the plant, and transportation of concrete to jobsite. Inspector shall verify that the amount of free surface moisture contained in fine and course aggregate has been properly accounted for in the concrete mixing to achieve required consistency and water cement ratio.

O. Testing laboratory shall monitor addition of water to concrete at the jobsite and the length of time concrete is allowed to remain in the truck before placement. Inspector shall compare mixture with criteria on the approved mix design and report any significant deviation to Architect, Contractor, and concrete supplier. Do not permit addition of water that will exceed maximum water/cement ratio for the mix as given on the approved mix design.

P. Observe placing of concrete except nonstructural slabs on grade and site Work. Observe and report on placing method, consolidation, cold joints, length of drop, and displacement of reinforcement. Report deficiencies to Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.

Q. Test reports shall include but not be limited to the following information:
1. Date of concrete placement.
2. Concrete mix identification number or proportion of ingredients.
3. Truck ticket number.
4. Time test was made.
5. Time of batching.
6. Location of each placement.
7. Slump, unit weight, water content (microwave test), and air content of concrete sampled.
8. Date and results of strength test.

R. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.

S. Testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and time at which cement and aggregate were dispensed into the truck, and time at which concrete was discharged from the truck.

T. Evaluation and Acceptance:
1. If measured slump or air content of air entrained concrete falls outside specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete shall be considered to have failed to meet the requirements of the Specifications, and shall not be used in the structure.
2. Strength level of concrete will be considered satisfactory if the averages of sets of three (3) consecutive strength test results are equal to, or exceed, specified strength and no individual test result (average of two [2] cylinders) is below specified strength by more than 500 psi.
3. Completed concrete work will be accepted when requirements of ACI 301 Chapter 18 *Specifications for Structural Concrete for Buildings* have been met.

U. Concrete Test Reports:
1. Reports shall be made and distributed immediately after respective tests or inspections are made:

a. Where reports indicate deviations from Contract Documents, they shall also include a determination of the probable cause of deviation and where applicable, a recommendation for corrective action.

V. Furnish a statistical analysis for each class of concrete placed on the Project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by the Architect. Information shall include, but not be limited to, the following:
1. Strength tests at seven (7) days.
2. Strength tests at 28 days of two (2) cylinder averages.
3. 28-day moving average strength tests of last three (3) test groups.
4. Standard deviation and coefficient of variation based on 28-day strength tests.
5. Average strength and number of 28-day tests for most recent month.
6. Strength test one (1) cylinder at 56 days in the event the 28-day strength tests do not meet strength requirements.

W. Test Footings (Shafts; Piers; Caissons): Same diameter and type specified for footings, placed in same manner. Accepted test footings may be used in the Work.

X. Noncompliant Test Reports: Fax test reports indicating noncompliance immediately to each party on the test report distribution list. Copies shall be on different colored paper.

Y. Inspect application of curing compound and monitor curing conditions to assure compliance with Specification requirements. Report curing deficiencies to Contractor immediately and submit a written report to Architect.

3.9 TESTING OF NONSHRINK GROUT

A. Make one (1) strength test for all plates grouted and for all grout used in joints between members.

B. Each test shall consist of four (4) cubes, two (2) tested at seven (7) days and two (2) at 28 days, made and tested in accordance with ASTM C109, with the exception that grout shall be restrained from expansion by a top plate.

3.10 STRUCTURAL STEEL

A. Inspect structural steel during and after erection for compliance with Contract Documents and shop drawings. Review and report on fabricator’s quality control procedures and capabilities.

B. Field Inspection:
1. Proper erection of pieces.
2. Proper touch up painting of shop primed structural steel exposed to view or in crawl space.
3. Proper installation of bolts.
4. Plumbness of structure and proper bracing.
5. Proper field painting.
6. Initial inspection of welding process and periodically thereafter as necessary.
7. Visual examination of completed welds.
8. Ultrasonic testing of penetration field welds.
9. Installation of field welded shear studs.
10. Inspect shop fabricated members, upon arrival at the site, for defects incurred during transit and handling.
11. Measure and record camber of beams upon arrival and before erection for compliance with specified camber. Measure lying flat with web horizontal. Return members outside

specified camber tolerance to shop for correction.

C. Qualifications of Welders: Fabricator and erector shall provide the testing laboratory with names of welders employed on Work, along with certification that each welder has passed qualification tests within the past 12 months, using procedures covered in AWS D1.1 *Structural Welding Code - Steel*. Verify welder qualifications.

D. Inspection of Field Welding shall Include:
1. Visually inspect fillet welds for size, soundness, and proper return around ends. Inspect seams, folds, and delaminations.
2. Visually inspect welds for proper repair of painting.
3. Ultrasonically test penetration welds in accordance with ASTM E164.
4. Inspect surfaces to be welded. Note surface preparations, fit up, and cleanliness of surface. Verify electrodes for size, type, and condition.
5. Welding inspector shall be present during alignment and fit up of members being welded, and shall verify for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, inspector shall order the joint to be chipped down to sound metal, or gouged out, and rewelded. Thoroughly inspect root passes for cracks. Gouge out cracks and rewelded to two inches (2”) beyond each end of crack.
6. Inspector shall verify that welds have been marked with welder’s symbol and shall mark welds requiring repairs and re-inspection. Inspector shall maintain a written record of welds. Work completed and inspected shall receive an identification mark by the inspector. Identify unacceptable material and Work identified by word *reject* or *repair* marked directly on the material.
7. Testing agency shall advise the Owner and Architect of any shop and/or field conditions that may require further tests and examination by means other than those specified. Additional tests and examinations shall be performed as authorized by the Owner and Architect.
8. Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.
9. Weld quality to comply with the American Institute of Steel Construction (AISC) Manual of Steel Construction.
10. Determine percentage of weld tested by the number of welds that fail the initial testing.
11. Reweld and retest welds that fail until the welds pass. Test two (2) additional welds for every weld failure.

E. Inspect bolted construction in accordance with AISC *Specification for Structural Steel Buildings*:
1. Visually inspect bolts ensuring that plies have been brought into snug contact.
2. Inspect high strength bolt in accordance with Section 9 of the *Specifications for Structural Joints Using ASTM A325 Bolts*.

F. Inspect stud welding in accordance with AWS D1.1 *Structural Welding Code*:
1. Weld at least two (2) shear studs at the start of each production period to determine correct generator, control unit, and stud welder setting. The studs shall be capable of being bent 45 degrees from vertical without weld failure.
2. When the temperature is below 32 degrees F, test one (1) stud in each 100 after cooling. Do not weld studs at temperatures below zero (0) degrees F or when surface is wet with rain or snow. If stud fails in the weld, two (2) new studs shall pass the test before resumption of welding.
3. Visually inspect studs for compliance with the requirements of the Contract Documents. Verify number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360-degree fillet has not been obtained for a particular stud, that stud shall be struck with a hammer and bent 15 degrees off

perpendicular in the direction away from the missing weld. Studs failing test shall be replaced.

3.11 REINFORCING STEEL MECHANICAL SPLICES

A. Inspection and Observation Services:
   1. Visually inspect and report on completed condition of each mechanical splice of reinforcing steel.
   2. Visually inspect each mechanical splice to ensure compliance with the ICC-ES Reports and the manufacturer's published criteria for acceptable completed splices.
   3. Place special emphasis on the inspection of the end preparation of each bar to be spliced required by the ICC-ES Report.

B. Reports:
   1. Submit reports to Architect:
      a. Copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
      b. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Indicate reasons for rejection on each report.

3.12 OPEN WEB JOISTS AND JOIST GIRDERS

A. Inspect joists at jobsite for compliance with specified fabrication requirements. Verify welded connections between web and chord, splices, and straightness of members.

B. Inspect installation of joists at jobsite. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for compliance with Contract Documents and referenced standards.

C. Verify welder qualification certificates for both shop and field welding operators.

3.13 METAL FLOOR DECK

A. Field inspection shall consist of:
   1. Verifying types, gauges, and finishes for compliance with Contract Documents and shop drawings.
   2. Examine composite floor deck exposed to crawl space for damage to galvanizing due to welding or construction activities. Repair galvanized composite floor deck in accordance with the Specifications.
   3. Examine the erection of metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting, or other coating.
   4. Certification of welders.
   5. Inspect and test field welded shear studs used to fasten metal floor decking to supporting steel as specified for structural steel.

3.14 METAL ROOF DECK

A. Field inspection shall consist of:
   1. Verify types, gauges, and finishes for compliance with Contract Documents and shop drawings.
   2. Examine the erection of the metal deck, including fastenings at supports and side laps, reinforcing of holes, and miscellaneous deck supports.
   3. Certification of welders.

4. Visual inspection of at least 25 percent of welds.

3.15 SPRAYED FIREPROOFING

A. Verify that applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.

B. Verify that installation complies with fire rating requirements of approved design.

C. Inspect and test for thickness:
1. Test 25 percent of structural frame columns and beams in each building level.
2. Test ten percent (10%) of beams other than structural frame in each building level.
3. Test one (1) slab per 5,000 square feet of building area.

D. Inspect and test in accordance procedures of ASTM E605 and ASTM E736.

3.16 EXPANSION BOLT INSTALLATION

A. Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.

B. Verify installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

3.17 LIGHTWEIGHT INSULATING CONCRETE FILL

A. Inspection and Observation Services (As Required):
1. Inspection of roof deck prior to start of Work.
2. Inspection during installation of insulation and lightweight insulating concrete fill Work to ascertain compliance with Contract Documents.
3. Observation of base ply fastener pull tests performed by Contractor to ascertain minimum withdrawal resistance of 40 pounds per fastener.

B. Testing Services (As Required):
1. References (as applicable for tests required):
   a. American Society for Testing and Materials (ASTM):
      1) C177 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded Hot Plate Apparatus.
      2) C495 - Test Method for Compressive Strength of Lightweight Insulating Concrete.
      3) C578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation.
2. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
3. Test lightweight insulating concrete fill in accordance with ASTM C495 for:
   a. Mix design compressive strength.
   b. Mix design wet and dry density range.
   c. Number of Tests:
      1) One (1) per 5,000 square feet.
      2) Not less than one (1) for each day's Work.
4. Test EPS insulation board for density in accordance with ASTM C578.

3.18 TESTING OF ROOFING

A. Inspection and Observation Services (As Required):
1. Inspection of roof deck prior to start of Work.

2. Inspect onsite condition of stored roofing materials.
3. Inspection during roofing, roof insulation, and sheet metal Work to ascertain compliance with Contract Documents.
4. Observation of roof test cuts performed by Contractor to ascertain that they are properly made.
5. Observation of patching of roof test cuts to ascertain that they are properly made.

B. Testing Services (As Required):
1. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with Specifications.

3.19 MASONRY

A. Inspection and Observation Services:
1. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
2. Review mortar design mixes.
3. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.

B. Testing Services:
1. References (as applicable for tests required):
a. ASTM International (ASTM):
1) C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
2) C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
3) C1019 - Standard Test Method for Sampling and Testing Grout.
2. Testing of Concrete Masonry Units (CMU):
a. Pre-construction - Perform the following tests in accordance with ASTM C140:
1) Compressive Strength.
2) Absorption.
3) Weight.
4) Moisture Content.
5) Dimensions.
3. Mortar Tests:
a. Pre-construction - Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project:
1) 28-day compressive strength.
2) Water retention.
b. Construction: Perform 28-day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
4. Refer to and include Work for reinforcing steel specified.
5. Grout tests:
a. Pre-construction - Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project:
1) Slump test.
2) 28-Day compressive strength.
b. Construction: Perform 28-day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
6. Prism test: Perform pre-construction 28-day compressive strength test on concrete masonry walls.

3.20 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes:
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29: Cutting and Patching.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 45 23

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities, including but not limited to:
1. Water service and distribution.
2. Sanitary facilities, including toilets, wash facilities, and drinking water facilities.
3. Heating and cooling facilities.
4. Ventilation.
5. Electric power service.
6. Lighting.
7. Telephone service (land line)
8. Waste disposal facilities.
9. Field office.
10. Storage and fabrication sheds.
11. Lifts and hoists.
12. Construction aids and miscellaneous services and facilities.
13. Environmental protection.
14. Pest control.
15. Enclosure fence.
16. Security enclosure and lockup.
17. Barricades, warning signs, and lights.
18. Temporary partitions.
19. Fire protection.
20. Accessories necessary for a complete installation.
21. Temporary signage.

B. Use Charges:
1. Installation, removal of, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of the Project, testing agencies, and authorities having jurisdiction.
2. Water and sewer service: Pay sewer service use charges for water used and sewer usage by all entities for construction operations.
3. Electric power service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.3 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Moisture Protection Plan:
1. Describe procedures and controls for protecting materials and construction from water absorption and damage:

a. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
b. Indicate procedures for discarding water damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged work.
c. Indicate sequencing of work that requires water, such as sprayed fire resistive materials, plastering, and tile grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust and HVAC Control Plan:
1. Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
a. HVAC system isolation schematic drawing.
b. Location of proposed air-filtration system discharge.
c. Waste handling procedures.
d. Other dust control measures.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Accessible Temporary Egress:
a. Comply with 2022 California Building Code (CBC) CCR Title 24, Part 2, (as adopted and amended by DSA).
b. Comply with applicable provisions in the U.S. Architectural and Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines (ADAAG), ICC/ANSI A117.1.

B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain Link Fencing: Minimum 2 inches (50 mm), 0.148-inch (3.8 mm) thick, galvanized steel, chain link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, ten (10) mils (0.25 mm) minimum thickness, with flame spread rating of 15 or less per ASTM E84.

D. Dust Control Adhesive Surface Walk-off Mats: Provide mats a minimum of 36 inches by 60 inches (914 mm x 1624 mm).

E. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool;

with maximum flame spread and smoke developed indexes of 25 and 50, respectively.

F. Lumber and Plywood: Comply with requirements in Sections 06 10 00: Rough Carpentry or 06 10 53: Miscellaneous Rough Carpentry.

G. Gypsum Board: Minimum 1/2-inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; Type X or Type C panels with tapered edges. Comply with Section 09 21 16: Gypsum Board Assemblies.

H. Paint: Comply with requirements in Section 09 90 00: Painting and Coating.

I. Tarpaulins: Fire resistive labeled with flame-spread rating of 15 or less.

J. Water: Potable.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project site documents including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
   3. Drinking water and private toilet.
   4. Coffee machine and supplies.
   5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F
   6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Drinking Water: Containerized, tap dispenser, bottled water drinking water units, including paper cup supply. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 degrees F to 55 degrees F (7.2 degrees C to 12.7 degrees C).

C. Electrical Outlets: Properly configured, NEMA polarized outlets to prevent insertion of 110V to 120V plugs into higher voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

D. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

E. HVAC Equipment:
   1. Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control:
      a. Heating units: Listed and labeled for type of fuel being consumed by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
      b. Permanent HVAC system: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction. Clean HVAC system as required in Section 01 77 00: Closeout Procedures and install new filter with MERV 11 or greater.

F. Air Filtration Units: Primary and secondary HEPA filter equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

3.2 INSTALLATION

A. 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 by progress of the Work:
   1. Locate facilities to limit site disturbance as specified in Section 01 10 00: Summary.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. Install temporary service. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage:
   1. Provide temporary utilities to remove effluent lawfully:
      a. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities:
   1. Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type,

number, location, operation, and maintenance of fixtures and facilities:

a. Disposable supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
b. Wash facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities:
1. Prevent dust, fumes, and odors from entering occupied areas:
   a. Prior to commencing Work, isolate the HVAC system in area where Work is to be performed according to coordination drawings:
      1) Disconnect supply and return ductwork in Work area from HVAC systems servicing occupied areas.
      2) Maintain negative air pressure within Work area using HEPA equipped air filtration units, starting with commencement of temporary partition construction and continuing until removal of temporary partitions is complete.
   b. Maintain dust partitions during the Work. Use vacuum collection attachments on dust producing equipment. Isolate limited Work within occupied areas using portable dust containment devices.
   c. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.

G. Ventilation and Humidity Control:
1. Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption:
   a. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service:
1. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Install electric power service underground unless otherwise indicated:
   a. Electric distribution - Provide receptacle outlets adequate for connection of power tools and equipment:
      1) Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length voltage ratio.
      2) Provide warning signs at power outlets other than 110 to 120-V.
      3) Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or traffic areas.
      4) Provide metal conduit enclosures or boxes for wiring devices.
      5) Provide four (4) gang outlets, spaced so 100-foot (30 m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

I. Lighting:
   1. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions:
      a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
      b. Install lighting for Project identification sign.

J. Telephone Service:
   1. Provide temporary telephone service in common use facilities for use by construction personnel, Architect, and inspection services. Install a minimum of one (1) telephone line(s) for each field office:
      a. Provide dedicated telephone line for each facsimile machine in each field office.
      b. At each telephone, post a list of important telephone numbers:
         1) Police and fire departments.
         2) Ambulance service.
         3) Contractor's home office.
         4) Contractor's emergency after-hours telephone number.
         5) Architect's office.
         6) Engineers' offices.
         7) Owner's office.
         8) Principal subcontractors' field and home offices.
      c. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

K. Electronic Communication Service:
   1. Provide a desktop computer and printer/scanner in the primary field office adequate for use by Architect, inspection services, and Owner to access Project electronic documents and maintain electronic communications:
      a. Internet service: Broadband modem, router, and ISP equipped with hardware firewall.
      b. Internet security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
      c. Backup: External hard drive, minimum one (1) terabyte, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

A. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241:
   1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas:
   1. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations:
      a. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
      b. Prepare subgrade and install sub-base and base for temporary roads and paved areas.
      c. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.

d. Delay installation of final course of permanent pavement until immediately before Substantial Completion.

C. Traffic Controls:
1. Comply with requirements of authorities having jurisdiction:
a. Protect existing site improvements to remain including curbs, pavement, and utilities.
b. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel.

E. Dewatering Facilities and Drains:
1. Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water:
a. Dispose of rainwater in a lawful manner that will not result in flooding the Project or adjoining properties, or endanger permanent Work or temporary facilities.

F. Project Signs: Not listed in 3.5 Below.
1. Provide Project signs as indicated. Unauthorized signs are not permitted:
a. Identification signs: Provide Project identification signs as indicated on Drawings.
b. Temporary signs:
1) Provide other signs as indicated and as required to inform public and individuals seeking entrance to the Project:
a) Provide temporary, directional signs for construction personnel and visitors.
c. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00: Execution.

H. Lifts and Hoists:
1. Provide facilities necessary for hoisting materials and personnel:
a. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: Use of elevators is not permitted.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SIGNS

A. Furnish and install a project sign 6’-0” by 8’-0” in size. Image will be provided to the graphics printing company by the Architect after Award of Contract. Contractor will be responsible for the cost of printing the image, mounting the sign on an aluminum substrate and installing the sign at the site. The sign will include the name of the project, District, name and title of Board of Trustees, District Superintendent, Contractor, Architect, and each of the project consultants.

B. Other signs permitted at the site:

1. Warning signs.
2. Directional signs.
3. Identification signs at field offices.
4. Emergency medical services sign.
5. Signs required by Authorities Having Jurisdiction
6. Storm Water Pollution Prevention Plan sign (SWPPP)

C. Contractor shall allow no other signs to be displayed at the project site, unless authorized by the Owner/District.

3.6 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities:
1. Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities to the satisfaction of Owner and Architect.

B. Environmental Protection:
1. Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control:
1. Provide measures to prevent soil erosion and discharge of soil bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of authorities having jurisdiction:
   a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree or plant protection zones.
   b. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
   c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   d. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control:
1. Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection:
1. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control:
1. Engage pest control services to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence:
1. Before construction operations begin, provide site enclosure fence to prevent people and animals from easily entering site except by entrance gates:

a. Extent of fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

H. Security Enclosure and Lockup:
1. Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each Work day.

I. Barricades, Warning Signs, and Lights:
1. Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress:
1. Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures:
1. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior:
a. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions:
1. Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate occupied areas from fumes and noise:
a. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side and fire retardant treated plywood on construction operations side.
b. Construct dustproof partitions with two layers of 6-mil (0.14 mm) polyethylene sheet on each side. Cover floor with two (2) layers of 6-mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood. Do not apply tape to finish floor surfaces:
1) Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water dampened foot mats in vestibule.
c. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
d. Insulate partitions to control noise transmission to occupied areas.
e. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
f. Protect air handling equipment.
g. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection:
1. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program:
a. Prohibit smoking in construction areas.
b. Supervise welding operations, combustion type, temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
c. Develop and supervise an overall fire prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post

warnings and information.

d. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.7 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan:
1. Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase:
1. Before installation of weather barriers, when materials are subject to wetting and exposure to airborne mold spores, protect as follows:
   a. Protect porous materials from water damage.
   b. Protect stored and installed material from flowing or standing water.
   c. Keep porous and organic materials from coming into prolonged contact with concrete.
   d. Remove standing water from decks.
   e. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase:
1. After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   a. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   b. Keep interior spaces reasonably clean and protected from water damage.
   c. Periodically collect and remove waste containing cellulose or other organic matter.
   d. Discard or replace water-damaged material.
   e. Do not install material that is wet.
   f. Discard, replace, or clean stored or installed material that begins to grow mold.
   g. Perform Work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Condition Phase of Construction:
1. After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   a. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   b. Use permanent HVAC system to control humidity.
   c. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits and moisture control:
      1) Hygroscopic materials that may support mold growth, including wood and gypsum-based products, which become wet during the course of construction and remain wet for 48 hours are considered defective and are to be removed and replaced.
      2) Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      3) Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.8 OPERATION, TERMINATION, AND REMOVAL

A. Supervision:
   1. Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance:
   1. Maintain facilities in good operating condition until removal:
      a. 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.

C. Temporary Facility Changeover:
   1. Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion unless otherwise required and approved by Owner and Architect.

D. Termination and Removal:
   1. Remove each temporary facility when need when its service has ended, when it has been 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 temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired:
      a. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
      b. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. 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 temporary entrances, as required by authorities having jurisdiction.

END OF SECTION 01 50 00

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products, including but not limited to:
   1. Product delivery, storage, and handling.
   2. Manufacturers' written warranties on products.
   3. Special warranties.
   4. Comparable products.

1.3 DEFINITIONS

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

B. Products:
   1. Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, *assembly*, and terms of similar intent:
      a. Named products: Items identified by manufacturer's product name, including make, model number, or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
      b. New products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
      c. Comparable product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 SUBMITTALS

A. Comparable Product Requests:
   1. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title, and Drawing number(s) and title(s):
      a. Include data to indicate compliance with the specified requirements.
      b. Architect's action: If necessary, Architect will request additional information or documentation for evaluation within one (1) week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven (7) days

of receipt of additional information or documentation, whichever is later:
1) Form of Approval: As specified in Section 01 33 00: Submittal Procedures.
2) Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal:
1. Comply with requirements in Section 01 33 00: Submittal Procedures. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options:
1. If Contractor is given option of selecting between two (2) or more products for use on Project, select a product compatible with products previously selected, even if previously selected products were also options:
a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 WARRANTY

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents:
1. Manufacturer's warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties:
1. Prepare a written document that contains appropriate terms and identification, ready for execution:
a. Specified form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
b. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time:
1. Comply with requirements in Section 01 77 00: Closeout Procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original

sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents, and to determine that products are undamaged and properly protected.

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

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements:
1. Provide products that comply with the Contract Documents, are undamaged, and unless otherwise indicated, are new at time of installation:
a. Provide products complete with accessories, trim, finish, fasteners, and items needed for complete installation and indicated use and effect.
b. Standard products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
c. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
d. Where products are accompanied by the phrase *as selected*, Architect will make selection.
e. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and characteristics based on the product named. Comply with requirements for consideration of an unnamed product by one of the named manufacturers.

C. Visual Matching Specification:
   1. Where Specifications require *match Architect's sample*, provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches:
      a. If no product available within specified category matches and complies with specified requirements, comply with requirements of Section 01 25 00: Substitution Procedures and Form for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase *selected by Architect* or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration:
   1. Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
      a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
      b. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
      c. Evidence that proposed product provides specified warranty.
      d. List of similar installations for completed projects with project names and addresses, and names and addresses of architects and owners, if requested.
      e. Samples, if requested.

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 60 00

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00: Project Management and Coordination.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor or professional Engineer to lay out the Work using accepted surveying practices:
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as necessary to locate each element of Project.
2. Establish limits on use of site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level, and plumb of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two (2) or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points:
1. Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations:

SECTION 01 73 00 EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor or professional Engineer certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

C. Certified Surveys: Submit two (2) copies signed by land surveyor.

D. Final Property Survey: Submit ten (10) copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor legally qualified to practice in the State of California, who is experienced in providing land surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain onsite manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In-Place Materials:
   1. Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible:
      a. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Existing Conditions:
   1. The existence and location of underground and other utilities and construction indicated as existing are not warranted. Before beginning site Work, investigate and verify existence and location of underground utilities, mechanical and electrical systems, and construction affecting the Work:
      a. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping, underground electrical services, and other utilities.
      b. Furnish location data for work related to the Work that must be performed by public utilities serving the site.

B. Examination and Acceptance of Conditions:
   1. Before proceeding with each component of the Work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations:
      a. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
      b. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
      c. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report:
   1. Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
      a. Description of the Work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.
      d. Recommended corrections.

D. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

a. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
b. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks:
1. Establish and maintain a minimum of two (2) permanent benchmarks on site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark:
a. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
b. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
c. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey:
1. Engage a land surveyor or professional Engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional Engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey:
a. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
b. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated:
1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2,440 mm) in occupied spaces and 90 inches (2,300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions ensuring the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items onsite and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check shop drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment:
1. Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions:
   a. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   b. Allow for building movement, including thermal expansion and contraction.
   c. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous. Materials containing asbestos and BCPs are prohibited.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to site for Owner's construction personnel.

B. Coordination:
1. Coordinate construction and operations of the Work with Work performed by Owner's construction personnel:
   a. Construction schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   b. Pre-installation conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's Work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. Clean site and Work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully:
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 degrees F (27 degrees C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
4. Use containers intended for holding waste materials of type to be stored.
5. Coordinate progress cleaning for joint-use areas where Contractor and other

contractors are working concurrently.

B. Site: Maintain site free of waste materials and debris.

C. Work Areas:
1. Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work:
   a. Remove liquid spills promptly.
   b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire Work area, as appropriate.

D. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials onsite. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00: Temporary Facilities and Controls.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with mechanical, plumbing, and electrical requirements.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00: Quality Requirements.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes procedural requirements for cutting and patching.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other work.

1.4 SUBMITTALS

A. Cutting and Patching Plan:
   1. Submit plan describing procedures at least ten (10) days prior to the time cutting and patching will be performed. Include the following information:
      a. Extent: Describe reason for and extent of each occurrence of cutting and patching.
      b. Changes to in-place construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
      c. Products: List products used for patching and firms or entities that will perform patching work.
      d. Dates: Indicate when cutting and patching will be performed.
      e. Utilities and mechanical and electrical systems:
         1) List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted:
            a) Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

B. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

C. Operational Elements:
   1. Do not cut and patch operating elements and related components that results in

reducing the capacity to perform as intended or that results in increased maintenance or decreased operational life or safety:
a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire suppression systems.
e. Mechanical systems' piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire detection and alarm systems.
i. Conveying systems.
j. Electrical wiring systems.
k. Operating systems of special construction.

D. Miscellaneous Elements:
1. Do not cut and patch the following elements or related components that change the load bearing capacity, resulting in a reduction of capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety:
a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain wall construction.
d. Equipment supports.
e. Piping, ductwork, vessels, and equipment.
f. Noise and vibration control elements and systems.
g. Sprayed fire resistive material.

E. Visual Requirements:
1. Do not cut and patch construction resulting 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:
a. If possible, retain original installer or fabricator to cut and patch exposed Work. If possible, engage original installer or fabricator. If original installer is not available, engage recognized, experienced, and specialized firm for the Work:
1) Processed concrete finishes.
2) Ornamental metal.
3) Matched veneer woodwork.
4) Preformed metal panels.
5) Roofing.
6) Firestopping.
7) Window system.
8) Fluid applied flooring.
9) Wall covering.
10) HVAC enclosures, cabinets, or covers.

F. Cutting and Patching Conference: Before proceeding, meet at site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with specified requirements.

B. Existing Materials:
   1. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible:
      a. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing 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 Services: Where removal, relocation, or abandonment is necessary, bypass existing services before cutting to avoid interruption of services to occupied areas.

3.3 CUTTING AND PATCHING

A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time, and complete without delay:
   1. Cut existing construction to provide for installation of components or performance of construction, and subsequently patch as necessary to restore surfaces to an original condition.
   2. 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. Temporary Support: Provide temporary support of Work to be cut.

C. 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.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of

free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00: Summary and what is shown on Drawings.

E. Cutting:
1. Cut existing 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:
   a. 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.
   b. Finished surfaces: Cut or drill from exposed or finished side into concealed surfaces.
   c. Concrete and masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   d. Excavating and backfilling: Comply with requirements in applicable earthwork specifications by cutting and patching operations.
   e. Mechanical and electrical services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   f. Proceed with patching after construction operations requiring cutting are complete.

F. Patching:
1. 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 of these Specifications:
   a. Inspection:
      1) Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   b. Exposed finishes:
      1) Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to 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.
2. Floors and walls: Where walls or partitions are removed, extend one finished area into another, patch and repair surfaces in new space. Provide even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
3. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior building enclosure: Patch components and restore enclosure to a weathertight condition.

END OF SECTION 01 73 29

SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 SUBMITTALS

A. Waste Management Plan: Submit plan within ten (10) days of date established for commencement of the Work.

B. Waste Reduction Progress Reports:
   1. Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
      a. Material category.
      b. Generation point of waste.
      c. Total quantity of waste in tons (tonnes).
      d. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
      e. Quantity of waste recycled, both estimated and actual in tons (tonnes).
      f. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
      g. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total

waste.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Firm having minimum ten (10) years of documented experience in specializing in waste management coordination.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference:
1. Conduct conference at site. Review methods and procedures related to waste management including, but not limited to, the following:
    a. Review and discuss waste management plan including responsibilities of waste management coordinator.
    b. Review requirements for documenting quantities of each type of waste and its disposition.
    c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
    d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
    e. Review waste management requirements for each trade.

1.6 PERFORMANCE REQUIREMENTS

A. Conform to County regulations regarding Solid Waste Control.

B. Achieve end of Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in

the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials**:**

1. Demolition waste:
    a. Asphalt paving.
    b. Concrete.
    c. Concrete reinforcing steel.
    d. Brick.
    e. Concrete masonry units.
    f. Wood studs.
    g. Wood joists.
    h. Plywood and oriented strand board.
    i. Wood paneling.
    j. Wood trim.
    k. Structural and miscellaneous steel.
    l. Rough hardware.
    m. Roofing.
    n. Insulation.
    o. Doors and frames.
    p. Door hardware.
    q. Windows.
    r. Glazing.
    s. Metal studs.
    t. Gypsum board.
    u. Acoustical tile and panels.
    v. Carpet.
    w. Carpet pad.
    x. Demountable partitions.
    y. Equipment.
    z. Cabinets.
    aa. Plumbing fixtures.
    bb. Piping.
    cc. Supports and hangers.
    dd. Valves.
    ee. Sprinklers.
    ff. Mechanical equipment.
    gg. Refrigerants.
    hh. Electrical conduit.
    ii. Copper wiring.
    jj. Lighting fixtures.
    kk. Lamps.
    ll. Ballasts.
    mm. Electrical devices.
    nn. Switchgear and panelboards.
    oo. Transformers.
2. Construction waste:
    a. Masonry and CMU.
    b. Lumber.
    c. Wood sheet materials.
    d. Wood trim.
    e. Metals.
    f. Roofing.
    g. Insulation.
    h. Carpet and pad.
    i. Gypsum board.
    j. Piping.

k. Electrical conduit.
l. Packaging - Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
    1) Paper.
    2) Cardboard.
    3) Boxes.
    4) Plastic sheet and film.
    5) Polystyrene packaging.
    6) Wood crates.
    7) Plastic pails.

1.7 WASTE MANAGEMENT PLAN

A. Develop a waste management plan and requirements. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition site clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan:
    1. List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures:
        a. Salvaged materials for reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
        b. Salvaged materials for sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
        c. Salvaged materials for donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
        d. Recycled materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
        e. Disposed materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
        f. Handling and transportation procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis:
    1. Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
        a. Total quantity of waste.
        b. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
        c. Total cost of disposal (with no waste management).
        d. Revenue from salvaged materials.

e. Revenue from recycled materials.
f. Savings in hauling and tipping fees by donating materials.
g. Savings in hauling and tipping fees that are avoided.
h. Handling and transportation costs. Include cost of collection containers for each type of waste.
i. Net additional cost or net savings from waste management plan.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

A. Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract:
   1. Comply with operation, termination, and removal requirements in Section 01 50 00: Temporary Facilities and Controls.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training:
   1. Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work:
      a. Distribute waste management plan to everyone concerned within three (3) days of submittal return.
      b. Distribute waste management plan to entities when they first begin work onsite. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls:
   1. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:
      a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
      b. Comply with Section 01 50 00: Temporary Facilities and Controls for the control of dust and dirt, environmental protection, and noise control.

E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches (300 mm) or more.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:
   1. Salvage items for reuse and handle:
      a. Clean salvaged items.
      b. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
      c. Store items in a secure area until installation.
      d. Protect items from damage during transport and storage.
      e. Install salvaged items to comply with installation requirements for new materials

and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:
   1. Salvage items for Owner's use and handle as follows:
      a. Clean salvaged items.
      b. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
      c. Store items in a secure area until delivery to Owner.
      d. Transport items to Owner's storage area designated by Owner.
      e. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors, unless otherwise designated by Owner.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING WASTE

A. Recycle paper and beverage containers used by onsite workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures:
   1. Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan:
      a. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin:
         1) Inspect containers and bins for contamination and remove contaminated materials if found.
      b. Stockpile processed materials onsite without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
      c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
      d. Store components off the ground and protect from the weather.
      e. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 DISPOSAL OF WASTE

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

B. Burning:
   1. Do not burn waste materials:
      a. Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

3.5 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-2 for demolition waste identification.

C. Form CWM-3 for construction waste reduction work plan.

D. Form CWM-4 for demolition waste reduction work plan.

E. Form CWM-5 cost/revenue analysis of construction waste reduction work plan.

F. Form CWM-6 cost/revenue analysis of demolition waste reduction work plan.

G. Form CWM-7 for construction waste

H. Form CWM-8 for demolition waste.

CWM FORMS ON FOLLOWING PAGES

FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	**GENERATION POINT**	**EST. QUANTITY OF MATERIALS RECEIVED* (A)**	**EST. WASTE - % (B)**	**TOTAL EST. QUANTITY OF WASTE* (C = A x B)**	**EST. VOLUME CY (CM)**	**EST. WEIGHT TONS (TONNES)**	**REMARKS AND ASSUMPTIONS**
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

FORM CWM-2: DEMOLITION WASTE IDENTIFICATION				
MATERIAL DESCRIPTION	**EST. QUANTITY**	**EST. VOLUME CY (CM)**	**EST. WEIGHT TONS (TONNES)**	**REMARKS AND ASSUMPTIONS**
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

FORM CWM-5: COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN								
MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

FORM CWM-6: COST/REVENUE ANALYSIS OF DEMOLITION WASTE REDUCTION WORK PLAN

MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mech. Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

END OF SECTION 01 74 19

CLOSE-OUT FORM "A"

SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

STATE OF CALIFORNIA COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the _____ of _____, the subcontractor who supplied, installed, and /or erected the Work described below, and that, he /she is duly authorized to make this Affidavit and Subcontractor Release:

   Project: Schroeder Elementary School HVAC Upgrade & Modernization

   Owner: Westminster School District Architect: PBK

   Work Performed: _____ Specification Section(s): _____

2. That all Work required under the subject subcontractor of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said subcontractor which have not been paid and satisfied in full.

3. That to the best of his / her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said subcontract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

4. That he / she has received full payment of all sums due him / her for materials furnished and services rendered by the undersigned in connection with the performance of said subcontract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said subcontract.

ATTEST (If Corporation)

_____
Name of Subcontractor

_____ _____
Secretary (By) (Title)

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

(Seal)

_____
(Notary Public Signature)

SECTION 02 21 00 SURVEYS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section relates to execution of survey construction staking and addresses the following:
   1. Personnel and applicable responsibilities for surveying and staking.
   2. Procedures and time limitations.
   3. Consideration of monuments and damage.

B. Contractor shall furnish and set construction stakes and marks to establish the lines and grades required for completion of the Work as shown on the Plans and specified in the Project Specifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

A. Construction staking shall be performed under the direction of a licensed land surveyor or registered professional Engineer familiar with construction surveying and staking.

B. Construction staking shall be performed as necessary to control the Work. Construction stakes and marks shall be furnished and set with accuracy adequate to assure that the completed Work conforms to the lines, grades, and sections shown on the Plans.

C. Contractor shall provide a construction staking request in writing to Owner and the Engineer no less than 72 hours prior to the desired time for construction staking to be performed.

D. Construction stakes shall be removed from the site by Contractor when no longer needed. Removal and disposal of construction staking materials is the sole responsibility of Contractor.

E. In the event Contractor’s operations destroy any of the survey control points, Contractor shall replace such control points at his expense, subject to verification by the Engineer. The cost of any such verification or replacement of the control surveys will be the sole responsibility of Contractor with no additional cost to Owner. Contractor will not be allowed any adjustment in Contract Time for such verification or replacement of survey control points.
   1. When applicable, DSA IR to review replacement stakes with General Contractor.

F. Contractor must preserve all Geographic Reference Stations, section corners, and all other legal property monuments of any kind during all construction and related activities. It is Contractor's responsibility to become familiar with the survey control and documentation of the site and surrounding property prior to conducting activities on the site that may potentially jeopardize such facilities.

G. Contractor shall give written notice to Owner and the Engineer at least five (5) working days

in advance of any need to disturb or destroy any of the monuments of the site. Contractor must receive approval for such destruction or disturbance from Owner and Engineer prior to conducting the work.

H. Only a professional land surveyor registered in the State of California will be permitted to perform surveying to reset or replace destroyed monuments. The professional land surveyor shall follow all rules, regulations, provisions, and laws of the State of California, as applicable for such work.

I. The cost of replacement of monuments destroyed or disturbed by Contractor will be the sole responsibility of Contractor and be at no additional cost to Owner.

END OF SECTION 02 21 00

SECTION 02 41 00 DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Furnishing all labor, materials, and equipment necessary for demolition, dismantling, cutting, and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:
      a. Protecting existing work to remain.
      b. Hazardous material identification and removal.
      c. Utility service and termination.
      d. Removing debris and equipment.
      e. Removal of items indicated on Drawings.
      f. Landscape and sprinkler demolition and reinstall.
      g. Disposal of material.

B. Related Sections:
   1. Section 01 50 00: Temporary Facilities and Controls.
   2. Section 01 57 13: Erosion control.
   3. Section 01 74 19: Construction Waste Management and Disposal.
   4. Section 02 21 00: Surveys.
   5. Section 31 00 00: Earthwork.
   6. Section 33 00 00: Utilities.

C. Regulatory Requirements:
   1. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.
   2. Coordinate clearing work with utility companies.
   3. Maintain emergency access ways at all times.
   4. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.3 SUBMITTALS:

A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.

B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

1.4 EXISTING CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during Work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

3.2 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

B. In accordance with generally accepted construction practices, Contractor shall be solely and completely responsible for working conditions at the jobsite, including safety of all persons and property during performance of the Work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Safety precautions prevent damage to existing elements identified to remain or to be salvaged and prevent injury to the public and workmen engaged onsite. Demolish roofs, walls, and other building elements in such a manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate onsite. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends:
   1. Protect existing items that are not indicated to be altered. Protect utilities designated to remain from damage.
   2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on Drawings.
   3. Protect bench marks from damage or displacement.

D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

E. Fire Safety: Contractor shall conform to Chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition," at all times during the construction process. A copy of this chapter can be provided.

F. Any construction review of Contractor's performance conducted by the geotechnical Engineer is not intended to include review of the adequacy of Contractor's safety measures in, on, or near the construction site.

G. Surface Drainage: Provide for surface drainage during period of construction in a manner to

avoid creating nuisance to adjacent areas. Contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of Work, regardless of cause, source, or nature of water.

H. Adjacent streets and sidewalks shall be kept free of mud, dirt, or similar nuisances resulting from earthwork operations.

I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

3.3 EXAMINATION

A. Examine conditions of work in place before beginning Work; report defects.

B. Report existence of hazardous materials or unsafe structural conditions.

3.4 PREPARATION

A. Scheduling:
   1. General: Coordinate and schedule demolition work as required by Owner and as necessary to facilitate construction progress.

B. Hazardous Materials:
   1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
   2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact Owner. Do not proceed with demolition until directed by Owner.

C. Utility and Service Termination:
   1. Locate and identify existing utility, service, and irrigation system components affected by Work of this Contract. Review existing record Drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
   2. Prior to beginning any demolition, properly disconnect all water, gas, and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
   3. Prior to demolition or disconnect, obtain Owner’s approval that such system does not impact facilities or systems beyond the extent of this Contract.
   4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project record documents.

D. Verify that existing plant life and features designated to remain are tagged or identified.
   1. Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by Owner and all protective measures are in place.

E. Coordinate the time and duration of all system disconnects with Owner.

3.5 DEMOLITION

A. General Requirements:

1. Clear areas required for access to site and execution of Work, including pavement, structures, foundations, vegetation, trash, and debris.
2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.

B. Fixture and Equipment Removal:
1. Remove existing fixtures and equipment as identified and shown on Drawings and required by Architect.
2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
3. Remove all conductors from conduit at all abandoned circuits.

3.6 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts, and similar components:
1. Review all Contract Documents showing crossing paths and potential points of interference.
2. Pot-hole or determine by other means the accurate depth and location of such utilities.
3. Incorporate all costs required to complete work under this Contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this Contract.
4. No additional cost to Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on Contract Drawings or can be reasonably inferred from surface conditions or components.

B. Remove all conductors from conduit at all abandoned electrical circuits.

C. Seal off ends of all piping, drains, and other components as directed by Architect and serving utility.

D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components:
1. Re-circuit all electrical as required.
2. Re-circuit all landscape irrigation valving and control systems as required.
3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets, and piping. Fine grade to maintain proper drainage flow pattern to drains.

E. Demolish structure in an orderly and careful manner:
1. Use of explosives prohibited.

3.7 SITE PAVEMENT REMOVAL

A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings:
1. Remove all paving by saw-cutting.

2. Remove concrete paving and curbing at locations shown on Drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.

B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings:
   1. Remove all paving by saw-cutting.
   2. Remove paving assembly as required to expose subgrade.

3.8 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

A. Clearing, Grubbing, and Planting Demolition:
   1. Remove grass and grass roots to a minimum depth of two inches (2") below existing grade.
   2. Remove all shrubs, plants, and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
   3. Remove only those trees that are specifically designated for removal, or as shown on the Drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than one inch (1") in diameter to a depth of two feet (2') below existing or finished grades, whichever is lower, and a minimum of five feet (5') beyond the edge of paving, structure, wall, or walkway.
   4. Hand cut existing tree roots over one inch (1") in diameter as necessary for trenching or other new construction. Apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
   5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
   6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the geotechnical Engineer.
   7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with Section 31 00 00: Earthwork.
   8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.
   9. Keep drains, catch basins, surface drainage courses, and related drainage system components clear of debris and construction materials.
   10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.9 DISPOSAL

A. Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.

B. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.

C. It is required that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).

D. Burning and Burying of Materials: **Not allowed**.

E. Haul Routes:
   1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
   2. Keep streets free of mud, rubbish, etc. Assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.

F. Remove demolished materials and debris from site on a daily basis.

3.10 CLEANING

A. Upon completion of work of this Section, promptly remove from the working area all scraps and debris.

B. Clean excess material from the surface of all remaining paved surfaces and utility structures.

C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 02 41 00

SECTION 02 41 13 SELECTIVE SITE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Furnishing all labor, materials, and equipment necessary for demolition, dismantling, cutting, and alterations as indicated, specified, and required for completion of the Project, as applicable. Includes items such as the following:
      a. Protecting existing work to remain.
      b. Cleaning soiled materials that are to remain.
      c. Disconnecting and capping utilities.
      d. Removing debris and equipment.
      e. Removal of items indicated on Drawings.
      f. Salvageable items to be retained by Owner as indicated on Drawings and during the pre-construction job walk.

B. Related Sections:
   1. Section 31 22 00: Grading.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to location as directed by Owner's representative.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse. Store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by Owner's representative, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

E. Replace: Remove and legally dispose of existing item(s) indicated and install new like item(s) that conform to Project Specifications.

1.4 QUALITY ASSURANCE

A. Comply with the following:
   1. Applicable codes, ordinances, and regulations of local, municipal, state, and federal authorities having jurisdiction.
   2. Obtain necessary permits and notices; post where required.
   3. Comply with safety requirements of the local fire department.
   4. Comply with ANSI A10.6.

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

C. Carefully perform demolition work by skilled workers experienced in building demolition procedures, using appropriate tools and equipment. Perform work, at all times, under the direct supervision of a supervisor approved by Owner's inspector.

D. Coordinate demolition with other trades to ensure correct sequence, limits, and methods of proposed demolition. Schedule work to create least possible inconvenience to the public and to facility operations.

E. Pre-Demolition:
1. Conduct conference at Project site seven (7) days prior to scheduled installation:
   a. Conference agenda shall include review and discussion of requirements of authorities having jurisdiction, instructions and requirements of serving utilities, sequencing and interface considerations, and Project conditions.
   b. Conference shall be attended by supervisory and quality control personnel of Contractor and all subcontractors performing this and directly related work. Submit minutes of meeting to design builder's representative for Project record purposes.

F. Ownership of Materials:
1. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from the site with further disposition at Contractor's option.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Items scheduled for salvage by Owner shall be delivered to a location designated by Owner's authorized representative. Items shall be cleaned, packaged, and labeled for storage.

B. Items scheduled for reuse shall be stored onsite and protected from damage, soiling, and theft.

C. Follow legal requirement to hand expose to the point of no conflict 24 inches on either side of the underground facility, so its exact location is known before using power equipment.

D. Note: If caught digging without a Dig Alert ticket, a fine of up to fifty thousand dollars ($50,000.00) may be assessed per California government code 4216.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: The onsite shallow sands encountered in the borings are considered non-expansive and following proper processing should be suitable for backfilling purposes provided they are free of deleterious materials and oversize particles. Import materials may also be used for backfilling. The onsite or imported materials being used for backfilling should be non-expansive (EI less than 20), and should be in compliance with the specifications of the Project's soils report.

B. Backfill and Native Fill Materials: The onsite soils may be reused as compacted engineered fill provided they comply with the requirements of satisfactory soil materials as described above.

C. Borrow/Imported Fill Material: Soil excavated from site or imported conforming to

requirements for fill material shall conform to Section 31 22 00: Grading.

D. Engineered Fill: Satisfactory soil materials/borrow fill material, as described above, placed in lifts no greater than eight inches (8”) thick (loose measurements) and each lift moisture conditioned. All engineered fill should be densified to a minimum relative compaction of 90 percent per ASTM D1557.

E. Backfill Material for Trenches: The onsite soils have been determined to be suitable for being used for backfilling purposes in trenches. Utility trenches should be backfilled with granular materials and mechanically compacted to at least 90 percent of the maximum dry density of the soils.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Drawings may not indicate in detail all demolition work to be carried out. Carefully examine existing conditions to determine full extent of demolition required. All utilities, whether shown on Drawings or not, to be capped at the property line U.N.O.

B. Repair damage due to demolition activities to existing improvements to remain at no additional cost to Owner. Repair or replace as directed by Owner’s inspector.

C. Take measures to avoid excessive damage from inadequate or improper means and methods, or improper shoring, bracing, or support. Repair or replace any resulting damage at no additional cost to Owner as directed by Owner’s inspector.

D. If conditions are encountered that vary from those indicated, notify Owner’s inspector for instructions prior to proceeding. Owner assumes no responsibility for actual condition of structures to be demolished.

E. Inform Owner immediately upon discovery of asbestos products, radioactive materials, toxic wastes, or other hazardous materials. Do not remove hazardous materials without Owner authorization.

F. Adjacent roadways/passageways:
1. Maintain fire department access through all phases of the Project.
2. Obstruction of streets, walks, or other adjacent facilities will not be allowed.

3.2 DIG ALERT NOTIFICATION

A. Before any excavation in or near the public right-of-way, Contractor must contact the Underground Service Alert or USA-North (Dig Alert) at 811 or 800-642-2444 for information on buried utilities and pipelines.

B. Delineation of the proposed excavation site is mandatory. Mark the area to be excavated with water soluble or chalk based white paint on paved surfaces or with other suitable markings such as flags or stakes on unpaved areas.

C. Call at least two (2) full working days prior to digging.

D. If the members (utility companies) have facilities within the work area, they will mark them prior to the start of excavation; if not, they will provide notice of no conflict. A different color is used for each utility type (electricity is marked in red, gas in yellow, water in blue, sewer in green, telephone and cable TV in orange).

3.3 GENERAL

A. Protection:
1. Do not begin demolition until safety partitions, barricades, warning signs, and other forms of protection are installed.
2. Provide safeguards, including warning signs, lights and barricades, for protection of occupants and the general public during demolition.
3. Provide and maintain fire extinguishers. Comply with requirements of governing authorities.
4. Maintain existing utilities that are to remain in service and protect from damage during operations.

B. Safety: If at any time safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify Owner's inspector. Do not resume demolition until directed by Owner's inspector.

C. Noise and Dust Abatement: Exercise all reasonable and necessary means to abate dust, dirt rising, and undue noise. Perform necessary sprinkling and wetting of construction site to allay dust as required by applicable codes and ordinances.

D. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Do not create hazardous or objectionable conditions, such as flooding and pollution, when using water.

E. Water for Dust Control: Contractor shall obtain and pay for all water required for dust control operations. This may include, but is not limited to, payment of deposits to utility for construction meter, and payment of all monthly service and water charges. Construction meter shall be in place throughout construction period unless alternative arrangements are made with the City of Westminster to provide construction water for all purposes. Contractor shall be aware of water moratoriums and restrictions, and shall immediately advise Owner of effects on construction schedules.

F. An eight-foot-high (8') chain link fence and gates shall be erected prior to any demolition operations at the construction limits perimeter. Coordinate the exact location with Owner.

G. Debris Removal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

H. Progress Cleaning: Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

I. Where performing contracted scope of work requires coring of existing concrete, brick masonry, or CMU structures (including walls, floors, and sitework), Contractor shall obtain and document means of verifying existence and location of embedded steel reinforcing materials within said concrete, brick, and CMU assemblies. Contractor shall locate reinforcement by means of noninvasive technology, such as X-ray photography, for the purposes of protecting said reinforcement in place and shall not damage any reinforcement materials (rebar, etc.) unless specifically detailed as such and approved by the authority having jurisdiction.

J. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

K. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

L. Contractor shall provide temporary weather protection during interval between demolition and removal of existing construction, on exterior surfaces, and new construction to ensure that no water leakage or damage occurs to structure or interior areas.

M. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

N. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

O. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials if exposed; repaired surfaces shall match existing adjacent surface color finish and texture:
   1. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

P. Disposal: Promptly dispose of demolished materials; do not allow demolished materials to accumulate onsite.

3.4 PREPARATION

A. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.

B. Utilities:
   1. The Drawings do not purport to show all below-grade conditions and objects on the site. Contractor shall perform field investigations as necessary to establish location of underground utility services and other features affecting earthwork.
   2. Mark location of underground utilities on asphalt pavement with paint.
   3. Disconnect and cap utility services; comply with requirement of governing authorities.
   4. Contractor shall arrange and notify utility company in advance of date and time when service needs to be disconnected.
   5. Do not commence demolition operations until associated disconnections have been completed.
   6. Should utilities and other below-grade conditions be encountered that adversely affect the Work, discontinue affected Work and notify Owner's representative and Architect and request direction. Unforeseen conditions will be resolved in accordance with provisions of the General Conditions of the Contract.
   7. Should a utility line or structure be damaged, immediately notify the responsible utility company or agency and notify Owner’s representative and Architect:
      a. Repair or replace all damaged utility lines and structures as directed by the responsible utility company or agency.
      b. Repair or replacement of damaged utility lines and structures whose location or existence has been made known to Contractor shall be at no change in the Contract Time and Contract price.

C. Structures to be demolished shall be inspected for hazardous materials; such materials shall be removed and disposed of before general demolition begins.

D. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner's representative and authority having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner's representative and authority having jurisdiction.

3.5 EXPLOSIVES

A. Explosives: Use of explosives will not be permitted.

3.6 DEMOLITION

A. Demolition, General:
1. With certain exceptions, Contractor shall raze, remove, and dispose of all buildings and foundations, structures, paving, fences, and other obstructions that lie wholly or partially within the construction limits identified on Drawings. The exceptions are utility-owned equipment and any other items the Owner/Documents may direct Contractor to leave intact or re-use onsite. Cease demolition immediately if adjacent structures appear to be in danger.
2. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
3. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner's representative and authority having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
4. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area:
   a. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
   b. Protect existing site improvements, appurtenances, and landscaping to remain.
   c. Completely remove below-grade construction, including foundation walls and footings.
5. Filling below-grade areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavement with soil materials according to requirements specified in Section 31 22 00: Grading.
6. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.
7. Unless otherwise indicated on the Plans, remove all demolished material from the site and dispose of at approved disposal sites. Comply with all requirements for recycling of demolished material as called for in Division 01 of this Specification. Contractor shall obtain necessary permits for the transportation of material from the site.

3.7 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES

A. Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of Work. Remove abandoned lines and cap unused portions of existing lines. Contractor is responsible for completely surveying the site and locating all existing utilities, above and below ground, before contracting to perform the work.

B. Asbestos – Cement (A-C) Pipe Removal and Disposal: The Plans for the Project may indicate that existing asbestos-cement pipe is to be removed from the ground. Where so indicated, Contractor shall excavate with care, expose the pipeline, and remove the A-C pipe to the nearest joint. Should the Plans not call out the removal of the A-C pipe and A-C pipe is encountered, Contractor shall obtain approval from Owner as to whether or not the A-C pipe is to be removed or can be left in place. Cutting of the pipe shall only be done if there is no other way to expose the length of pipe to the nearest joint that be separated and Owner

approves the cutting of the pipe. Cutting of the pipe shall be done with a mechanical saw with a pressure water source to dampen the pipe and the dust from the cutting. To remove a coupling, the coupling may have to be broken in the trench. The pipe once removed from the trench may be broken for handling. The breaking shall be done within a plastic bagging or sheeting material to minimize the release of asbestos fibers into the atmosphere. Once removed and broken, if necessary, the A-C material shall be bagged and disposed of legally with Owner being given a copy of all Contractor paperwork as to the legal disposal of the material. If the A-C pipe section(s) are removed intact, the pipe can be removed by Contractor from the Project site and become the property and responsibility of Contractor.

3.8 CLEANING

A. Clean existing materials to remain, using appropriate tools and materials.

B. Protect adjacent materials and equipment during cleaning operations.

3.9 RESTORATION

A. Restoration of Site Finishes:
   1. Concrete paving: Where it is necessary to excavate a trench across, make a cut in concrete paved areas, cut concrete with cutting saw, full depth of paving.
   2. Bituminous paving: Where it is necessary to excavate a trench across, make a cut in bituminous paved areas, either first score paving with a concrete cutting saw, in neat straight lines, prior to removing paving, or make straight cuts with pneumatic spade.
   3. Restoration of paving: Restore all paved areas to their original condition using material of like type and quality as the removed paving. Paving in public ways shall conform to applicable requirements of authorities having jurisdiction. Repaired surfaces shall match existing adjacent paving except minimum depth shall be 3-1/2 inches where existing paving is less than 3-1/2 inches.
   4. Restoration of landscape planting: Restore soil and plant materials to match original condition, including additional topsoil, topsoil grading and preparation, new plant materials, and plant maintenance during establishment period.

3.10 MAINTENANCE

A. Install and maintain all erosion control devices, including sandbag and gravel bag dikes, silt fences, de-silting basins, inlet barricades, vehicle wash traps, and other features called for in the Storm Water Pollution Prevention Plan and Temporary Erosion Control Plans.

3.11 CLEAN-UP/DISPOSAL

A. Coordinate building access with the Owner's inspector. Review and schedule waste storage and removal, include truck access to site.

B. Debris shall be dampened by fog water spray prior to transporting by truck.

C. Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.

D. Remove waste and debris other than items to be salvaged. Turn over salvaged items to Owner, or store and protect for reuse where scheduled. Continuously clean-up and remove items as demolition work progresses. Do not allow waste and debris to accumulate in building or onsite.

END OF SECTION 02 41 13

SECTION 02 41 19 SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected portions of existing tile roofing.
   3. Demolition and removal of selected site elements.
   4. Accessories necessary for demolition and deconstruction.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose off-site.

B. Remove and Reinstall: Detach items from existing construction with care to prevent damage, clean and refurbish, prepare for reuse, store as necessary, and reinstall where indicated.

C. Deconstruct: To remove by disassembling or detaching an item from a surface, using methods and equipment to successfully prevent damage to the item and surfaces, and dispose of items.

1.4 SUBMITTALS

A. Qualification Data: Submit copies of qualifications for refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building and roof structures.

C. Proposed Protection Measures: Submit report, including Drawings, indicating proposed measures for protecting individuals and property, for environmental protection, dust control, and noise control. Indicate proposed locations, types, and construction of barriers.

D. Schedule of Selective Demolition Activities:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's onsite operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

E. Inventory: Submit a list of items for removal and location of storage of existing items to be removed, saved, and replaced (tile roofing)

F. Pre-Demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that could be construed as damage caused by demolition operations. Submit prior to commencement of the work.

G. Statement of Refrigerant Recovery: Submit statement signed by refrigerant recovery technician responsible for recovering refrigerant, stating that refrigerant present was recovered and recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

H. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Demolition Standards: Comply with ASSE A10.6 and NFPA 241.
2. Comply with EPA regulations prior to commencement of the work. Comply with hauling and disposal regulations of authorities having jurisdiction.
3. Comply with applicable federal, state, and local codes for demolition work, dust and noise control, safety of structure, and debris removal.
4. Obtain required permits from authorities having jurisdiction.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA approved certification program.

C. Pre-demolition conference to be conducted at the site:
1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction scheduled to remain and requires protection.
6. Review with Owner staging areas for equipment and material storage and removal.

D. Arrange selective demolition schedule to avoid interference with Owner's and the school’s operations.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor prior to proceeding. Existing warranties to be provided by Owner prior to the start of construction.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying existing system has been inspected and warranty remains in effect. Submit supporting documentation at closeout.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and the contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

PART 2 PRODUCTS

2.1 MATERIALS

A. Repair Materials:
   1. Use repair materials identical to existing materials:
      a. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
      b. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide minimum of 72 hours' notice to Owner of demolition activities that will affect Owner's operations, including but not limited to:
   1. Interruption of power.
   2. Interruption of utility services.
   3. Excessive noise.

B. Condition of Structure:
   1. Conditions existing at time of inspection will be maintained by Owner as far as practical. Owner assumes no responsibility for actual condition of items or structures to be demolished:
      a. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
      b. Before commencing selective demolition, Owner will remove the following items:
         1) Classroom equipment (tables, chairs, and District owned items).
         2) Roof top equipment is **not** part of the demolition scope of work.

C. Hazardous Materials:
   1. It is not anticipated that hazardous materials will be encountered in the Work:
      a. Hazardous materials will be removed by Owner before start of the Work.
      b. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by at least 12 inches (300 mm).

E. Storage or sale of removed items or materials onsite is not permitted.

F. Traffic:
   1. Conduct operations and debris removal to ensure minimum interference with roads, streets, drives, fire lanes, walks, accessible paths, and adjacent occupied or used facilities:
      a. Do not close, block, or obstruct streets, drives, walks, or occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around obstructed traffic ways.

G. Explosives: Explosives are **not** permitted at the site.

H. Flame Cutting: Do not use cutting torches for removal until flammable materials are removed. At concealed spaces, verify conditions prior to flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.

I. Environmental Controls: Use water sprinkling, temporary enclosures, or other acceptable methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions.

J. Utility Services:
   1. Maintain existing utilities and protect against damage during demolition operations:
      a. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to Owner and governing authorities.

K. Protections:
   1. Provide temporary barriers to protect Owner's personnel and public from injury from work:
      a. Take protective measures to provide free and safe passage to occupied portions of building.
      b. Provide protection to ensure safe passage of Owner’s personnel and the public around demolition areas and to and from occupied portions of adjacent areas, buildings, and structures.
      c. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or Work to remain.
      d. Protect existing Work that becomes exposed during demolition operations:
         1) Protect existing improvements, appurtenances, and conditions to remain.
         2) Protect adjacent floors with coverings.
         3) Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.
      e. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks. Refer to Drawings for location of partitions to be provided.
      f. Provide temporary weather protection when exposing exterior conditions to prevent water leakage or damage to structure or interior areas of existing building.

L. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

3.2 EXAMINATION

A. Verify that affected utilities have been disconnected and capped before commencing selective demolition operations.

B. Review Project record documents of existing construction or existing condition and hazardous material information provided by Owner. Owner does not warrant existing conditions are same as those indicated in Project record documents.

C. Perform an engineering survey of condition of building to determine whether removing an element might result in structural deficiency or unplanned collapse of a portion of structure or adjacent structures during selective building demolition operations:
   1. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions:
   1. Record existing conditions with measured drawings or preconstruction photographs or video and templates:
      a. Inventory and record the condition of items to be removed. Provide photographs or video of conditions that might be misconstrued as damage caused by operations.
      b. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
      c. For any electrical or low-voltage work to be performed in the Project (including fire alarm, PA, intercom, or data), test entire system for operation prior to initiation of work. Notify Owner of any non-working components. Test entire system at the end of construction to ensure all systems operate properly.

3.3 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Pest Control: Employ certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

C. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Comply with requirements for access and protection.

D. Temporary Facilities:
   1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain:
      a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
      b. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
      c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
      d. Cover and protect furniture, furnishings, and equipment that have not been removed.
      e. Comply with requirements for temporary enclosures, dust control, heating, and cooling.

E. Furnishings and Equipment: Cover and protect furniture, equipment, and fixtures from spoilage or damage as necessary.

F. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise:
   1. Construct dustproof partitions of not less than nominal four-inch (100mm) studs, 5/8-inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2-inch (13mm) fire retardant plywood on the demolition side.
   2. Insulate partition to provide noise protection to occupied areas.

3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air handling equipment.
5. Weatherstrip openings to prevent the spread of dust.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished:
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. Arrange to shut off utilities with utility companies.
   3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   4. Disconnect, demolish, and remove fire suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed:
      a. Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Piping to be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
      c. Equipment to be removed: Disconnect and cap services and remove equipment.
      d. Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      e. Equipment to be removed: Disconnect and cap services and remove equipment and deliver to Owner.
      f. Ducts to be removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
      g. Ducts to be abandoned in place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.5 POLLUTION CONTROLS

A. Dust Control:
   1. Use water mist, temporary enclosures, and suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations (XXAQMD) including, but not limited to XXAQMD Rule 403 (Fugitive Dust):
      a. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
      b. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

3.6 PROTECTION

A. Temporary Protection:
   1. Provide temporary barricades and protection required to prevent injury to people and damage to adjacent buildings and facilities to remain:
      a. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building:
         1) Erect temporary pathways and means of egress necessary for ongoing operations compliant with Code and accessibility regulations.
      b. Provide temporary weather protection, during interval between selective demolition

of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations:
   1) Protect existing work that becomes exposed during demolition operations.
   2) Protect adjacent entrances from damage due to demolition activities.
   3) Protect existing improvements, appurtenances, and conditions to remain.
   4) Protect floors with covering.
   5) Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.

2. Cover and protect furniture, furnishings, and equipment that have not been removed.
3. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00: Temporary Facilities and Controls:
   a. Construct temporary, insulated dustproof partitions to separate areas from noisy or extensive dirt or dust when operations are performed. Equip partitions with dustproof doors and security locks.
   b. Construct dustproof partitions of not less than nominal four-inch (100mm) studs, 5/8-inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2-inch (13mm) fire retardant plywood on the demolition side.
   c. Insulate partition to provide noise protection to occupied areas.
   d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
   e. Protect air handling equipment.
   f. Weatherstrip openings.
4. Damage: Promptly repair damages to adjacent components caused by demolition activities.

B. Temporary Shoring:
   1. Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished:
      a. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.7 SELECTIVE DEMOLITION

A. Demolish and remove existing construction to the extent necessary for new work. Use methods required to complete the work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
   5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
   6. Maintain adequate ventilation when using cutting torches.

7. Remove decayed, vermin infested, and dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials to avoid imposing excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and adjacent occupied and used facilities.

C. Removed Items:
1. Clean and pack or crate items after cleaning. Identify contents of containers. Store items in secure area until delivery to Owner:
   a. Transport items to Owner's storage area designated by Owner. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse:
   a. Pack or crate items after cleaning and repairing. Identify contents of containers.
   b. Protect items from damage during transport and storage.
   c. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items may be removed to a suitable, protected storage location during selective demolition, cleaned, and reinstalled in original locations after selective demolition operations are complete.

F. Patching and Repair: Repair damage to adjacent construction caused by selective demolition operations promptly.

3.8 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Remove to nearest control joint where possible. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, and then break up and remove.

E. Interior Slab on Grade: Use best practice removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.

F. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI *Recommended Work Practices for the Removal of Resilient Floor Coverings*. Do not use methods requiring solvent-based adhesive strippers**.**

G. Below Grade Voids: Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over six inches (150mm) in diameter, roots, or other organic matter.

H. Partitions: Completely remove indicated interior partitions and interior finishes indicated. Leave adjacent work scheduled to remain sound and ready for patching or for new finishes.

I. Doors and Frames:
   1. Remove from site:
      a. Remove doors, frames, and hardware where indicated. Clean, store, and protect for reinstallation or return hardware to Owner as directed.

J. Cut existing masonry walls for new doors, windows, or openings indicated. Leave openings ready to receive new work or patching.

K. Windows: Remove existing windows where indicated. Remove associated anchors, shims, blocking, operating devices, sealant, and trim. Cut back interior finishes required for plumb surface for patching. Leave openings ready for installation of new materials and finishes.

L. Mechanical, Electrical, and Structural Elements:
   1. If unanticipated mechanical, electrical, or structural elements conflicting with intended function or design are encountered, investigate and measure both nature and extent of the conflict:
      a. Submit written report to Architect in accurate detail. Pending receipt of directive, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
      b. HVAC Equipment: Remove air conditioning equipment without releasing refrigerants.

3.9 REMOVAL OF STRUCTURAL ELEMENTS

A. Foundation: Demolish foundation walls to a minimum depth of 12 inches (300mm) below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.

B. Pneumatic Operated Hammers:
   1. When possible, reduce use of pneumatic operated hammers. When necessary to use pneumatic tools, locate compressors as remote from occupied areas as possible:
      a. To break large pieces of concrete, isolate concrete from floor slabs and building structure to prevent structure borne vibration.

C. Saw Cutting:
   1. Locate compressors as remote as possible from occupied areas of facility:
      a. Use diamond tipped saw blades and related equipment.
      b. Saw cut portions of walls and slabs. Angle saw blade at floors and corners to cut as closely as possible to desired location.
      c. Control runoff water used with saw to prevent damage to existing materials.

3.10 ROOF REMOVAL

A. Roof Assembly:

1. Remove existing roofing to the extent that can be covered in one day by new roofing. Maintain building interior in watertight and weathertight condition:
   a. Remove existing roof membrane, flashings, copings, and roof accessories.
   b. Remove existing roofing system down to substrate.

B. At new column extensions, cut through roofing as required for welding of new extension. Provide temporary watertight enclosure over stubs and temporarily flash to existing roof to make completely watertight.

C. At existing parapets, remove portions of roofing, flashing, stone, and masonry necessary to weld new steel and set form work. Provide temporary watertight enclosures over areas of open roof and temporarily flash to make watertight.

D. As column forms are placed, temporarily flash columns to existing roofing and cover with watertight tarpaulins before and after pouring. After column forms have been removed, temporarily flash new concrete structure into existing roofing immediately to maintain watertight roof.

E. When removing roofing to place supports for shoring of form work to transfer loads to existing columns or approved structure or to support scaffolding, work platforms, or similar loads, temporarily flash supports to make roof watertight.

F. Remove excess residue. Thoroughly clean and remove asphalt, dust, and loose materials, and leave ready for new work.

3.11 PATCHING AND REPAIRS

A. Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Section 01 73 29: Cutting and Patching.

C. Repairs:
1. When necessary to repair existing surfaces, patch to produce surfaces suitable for new materials:
   a. Fill holes and depressions in existing masonry walls to remain with masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Floors and Walls:
1. Where walls or partitions are demolished, extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance:
   a. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   b. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
   c. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.12 DISPOSAL OF DEMOLISHED MATERIALS

A. Legally remove demolition waste materials from site and dispose in an EPA approved construction and demolition waste landfill acceptable to authorities having jurisdiction; recycle or reuse components:
   1. Do not allow demolished materials to accumulate onsite.
   2. Remove and transport debris to prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or devices that convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.13 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 10 00 CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section is related to concrete forming and accessories and includes:
   1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
   2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.
   3. Openings for other work.
   4. Form accessories.
   5. Form stripping.

B. Related Sections:
   1. Section 03 20 00: Concrete Reinforcing.
   2. Section 03 30 00: Cast-in-Place Concrete.
   3. Section 05 12 00: Structural Steel Framing.

C. Reference Standards:
   1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
   2. ACI 301 Specifications for Structural Concrete.
   3. ACI 318-14 Building Code Requirements for Structural Concrete and Commentary.
   4. ACI 347 Guide to Formwork for Concrete.
   5. National Institute of Standards and Technology - PS 1 Structural Plywood.
   6. 2022 California Building Code, Chapter 19A.
   7. APA American Plywood Association Design and Construction Guide.
   8. Local AQMD - XXAir Quality Management District.

1.3 SUBMITTALS

A. See Section 01 33 00: 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.

1.4 QUALITY ASSURANCE

A. Comply with the pertinent provisions of Section 01 40 00: 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."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 60 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

2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to 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 347, ACI 301, and ACI 318.

2.2 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, WWPA No. 1 grade or better; with grade stamp clearly visible.

2.3 REMOVABLE PREFABRICATED FORMS

A. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; two inches (2”) thick.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, or equal, not leaving metal within 1-1/2 inches of concrete surface.

B. Form Release Agent:
   1. Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bug holes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied:
      a. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable oil-based compound.
      b. Do not use materials containing diesel oil or petroleum-based compounds.
      c. VOC content: In compliance with applicable local, state, and federal regulations.

C. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00: Structural Steel Framing.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 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 three inches (3") clear cover to reinforcement and indicates the member is cast against earth. Remove formwork prior to backfilling operations.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 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-inch by 3/4-inch 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.

3.4 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.

3.5 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 Section 03 30 00: Cast-In-Place Concrete, 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 inches 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 reinforcing.
3. Sleeves: Pipe sleeves may pass through the slab or walls if not exposed to rusting or other deterioration and are of uncounted or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.
4. Conduits may be embedded in walls only if the outside diameter does not exceed 1/3 the wall thickness, are spaced no closer than three (3) diameters on centers, and not impair the strength of the structure.

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. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

I. 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.

J. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fit so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Deflection: Limit deflection of forming surfaces from concrete pressure to L/240.

C. Finish Lines:
1. Position formwork to maintain hardened concrete finish lines within following permissible deviations:
   a. 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

   b. 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

   c. Cross-sectional dimensions:

Minus	1/4 inch
Plus	1/2 inch

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00: 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.

3.9 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. Load supporting forms may be removed when concrete has attained 75 percent of required 28-day compressive strength, but no sooner than three (3) days, provided construction is reshored. Vertical formwork for cast-in-place concrete walls may be removed no sooner than one (1) day following concrete placement, provided that 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 03 10 00

SECTION 03 15 00 CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes wheel stops.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For wheel stops, six inches (150 mm) long showing color and cross section, with fasteners.

PART 2 PRODUCTS

2.1 PARKING BUMPERS

A. Concrete Wheel Stops:
   1. Precast, steel-reinforced, air-entrained concrete, 4,000-psi (27.6-MPa) minimum compressive strength, 4-1/2 inches (115 mm) high by nine inches (225 mm) wide by 72 inches (1,800 mm) long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two (2) factory-formed or drilled vertical holes through wheel stop for anchoring to substrate:
      a. Surface appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
      b. Mounting hardware: Galvanized-steel hardware as standard with wheel-stop manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

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

3.2 WHEEL STOP INSTALLATION

A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.

B. Install wheel stops in bed of adhesive before anchoring.

C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION 03 15 00

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section is related to concrete reinforcement and includes:
   1. Reinforcing steel for cast-in-place concrete foundations.
   2. Reinforcing steel for cast-in-place concrete slabs-on-grade.
   3. Supports and accessories for steel reinforcement.

B. Related Sections:
   1. Section 03 10 00: Concrete Forming and Accessories.
   2. Section 03 30 00: Cast-in-Place Concrete.
   3. Section 05 12 00: Structural Steel Framing.

C. Reference Standards:
   1. ACI 301 Specifications for Structural Concrete.
   2. ACI 318 Building Code Requirements for Structural Concrete and Commentary.
   3. ACI SP-066 ACI Detailing Manual.
   4. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   5. ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
   6. ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   7. ASTM D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
   8. AWS D1.4 Structural Welding Code - Reinforcing Steel.
   9. CRSI Concrete Reinforcing Steel Institute Manual of Standard Practice.
   10. CRSI Concrete Reinforcing Steel Institute Placing Reinforcing Bars.

1.3 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

B. Shop Drawings:
   1. Comply with requirements of ACI SP-066. Include the following:
      a. Complete bar layout.
      b. Representative sections.
      c. Details for congested conditions.
      d. Proposed layout where vertical and horizontal bars intersect.
      e. Bar schedules.
      f. Typical bending diagrams and offsets.
      g. Shapes of bent bars.
      h. Spacing of bars.
      i. Splice lengths and locations.

C. Where welding is proposed:
   1. Detail welding to conform to AWS D1.4.

2. Submit copies of welding operator's certificate.
3. Where reinforcement complying with ASTM A615 is to be welded, chemical tests shall be performed to determine the weldability in accordance with ACI 318.
4. Weld procedure specifications (WPS):
   a. All WPS's shall be submitted to the Structural Engineer of Record (SEOR) for review and approval prior to use.
   b. For WPS's that have been qualified by test, the supporting Procedure Qualification Record (PQR) shall be submitted to the SEOR for review and approval.
   c. Included shall be WPS for repair welds.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

A. Comply with the pertinent provisions of Section 01 40 00: Quality Requirements.

B. Perform work of this Section in accordance with ACI 301.

C. Welders' Certificates: Submit certifications for welders employed on the Project, verifying AWS qualification within the previous 12 months.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 60 00: 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.

D. Extra Material:
1. Provide an allowance of an additional ten percent (10%) of the total reinforced 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

2.1 REINFORCEMENT

A. Reinforcing Steel:
1. ASTM A615/A615M, Grade 60 (60,000 psi):
   a. Deformed billet-steel bars.
   b. Unfinished.
   c. Only to be used for conditions where bars will not be welded.

B. Reinforcing Steel:
1. ASTM A706/A706M, Grade 60 (60,000 psi) deformed low-alloy steel bars:
   a. Unfinished.
   b. Used in all cases where welding of bars is required.

C. Reinforcement Accessories:
1. Tie wire: ASTM A1064, annealed copper bearing steel, minimum 16 gage, 0.0508 inch.
2. Chairs, bolsters, bar supports, spacers:

a. 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.

D. Welding electrodes: AWS D1.4, Table 5.1 and 5.3, low hydrogen electrodes, E8018 for Grade 60 steel.

2.2 REBAR SPLICING

A. Coupler Systems: Mechanical devices for splicing reinforcing bars conforming to the requirements of ACI 318; capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression.

B. For reinforcement, all mechanical splices in Special Structural Walls, Special Moment Frames, and Concrete Diaphragms shall be Type 2, conforming to the requirements of ACI 318, capable of developing 1.25fy of the steel reinforcing yield strength in tension and compression, and develop the specified tensile strength of the spliced bar:
1. Products:
a. Dayton Superior Corporation; Bar Lock Coupler System: www.daytonsuperior.com (ICC-ESR 2481).
b. Lenton Lock Couplers (IAPMO-ES 129).

C. Dowel Bar Splicer with Dowel-Ins:
1. Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.
a. Products:
1) Dayton Superior Corporation; Dowel Bar Splicer D101A with Straight Dowel-In: www.daytonsuperior.com.
2) Lenton Form Savers (IAPMO-ES 129).

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI - 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. Welding:
1. Use only ASTM A706 steel where welding is proposed:
a. Perform welding where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using specified low hydrogen electrodes.
b. Preheat six inches (6") each side of joint.
c. Protect joints from drafts during the cooling process; accelerated cooling is prohibited.
d. Do not tack weld bars.
e. Welding shall not be done on or within two (2) bar diameters of any bent portion of a bar that has been bent cold.
f. Welding of crossing bars shall not be permitted for assembly reinforcement unless

authorized by the SEOR.

g. Clean metal surfaces to be welded of all loose scale and foreign material.
h. Clean welds each time electrode is changed and chip burned edges before placing welds.
i. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration to the base metal.
j. Cut out welds or parts of welds found defective with chisel and replace with proper welding.
k. Fillet welds may be considered prequalified per AWS D1.4.
l. Other welds are to be qualified per AWS D1.4.

D. Where ASTM A615 steel is to be used or occurs in existing elements and is to be welded:
1. Complete chemical analyses shall be performed to determine chemical composition and, for a new bar, provided in the mill certifications to determine weldability in accordance with ACI 318 with modifications per AWS D1.4.
2. The carbon equivalency (CE) shall be clearly defined and bars with a CE above 0.75 shall not be welded.
3. Welding Procedure Specifications and supporting PQRs with required testing per AWS D1.4 shall be provided for review and approval prior to welding.
4. These WPS and PQRs shall be specific to the CE as determined above, and shall, in addition to the other AWS requirement, include minimum and maximum preheat and interpass temperatures that are specified to the CE. This preheat and interpass temperature shall be strictly enforced in the field.
5. If separate shipments of bars vary the weldability, the process listed in the above requirements shall be repeated for these new bars.

E. Locate reinforcing splices not indicated on Drawings at point of minimum stress. Review locations of splices with SEOR.

PART 3 EXECUTION

3.1 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 per requirements on Drawings.

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 inches longitudinally in alternate bars and opposite faces.

F. Field Welding: As specified for fabrication.

3.2 FIELD QUALITY CONTROL

A. Comply with all pertinent provisions of Section 01 40 00: Quality Requirements.

B. Supervision: Perform Work to this Section under supervision of a capable superintendent.

C. An independent testing agency, as specified in Section 01 40 00: Quality Requirements, shall inspect installed reinforcement for conformance to Contract Documents before concrete placement.

D. Where welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the testing laboratory welding inspector in accordance with Chapter 17 of the CBC. The welding inspector shall make a systematic record of all welds:
1. Identification marks of welders.
2. List of defective welds.
3. Manner of correction of defects:
    a. The welding inspector shall check the material, equipment details of construction and procedures, as well as the welds. The inspector shall check the ability of the welder. The welding inspector shall furnish the structural Engineer and the enforcement agency with a verified report that the welding required to be inspected is proper and has been done in conformity with the approved Plans and Specifications. The welding 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 assure the adequacy of the welding.

END OF SECTION 03 20 00

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings and foundation walls.
   2. Interior slabs-on-grade.
   3. Exterior slabs-on-grade.

B. Special Coordination Requirements: Coordinate with the work of the following Sections to identify the finish flooring manufacturer's concrete slab requirements. Such requirements may be over and above the requirements of the Contract Documents and may require additional materials, means, or methods, which shall be included as part of the Work.

C. Related Sections:
   1. Section 01 32 00: Construction Progress Documentation.
   2. Section 03 10 00: Concrete Forming and Accessories.
   3. Section 03 20 00: Concrete Reinforcing.
   4. Section 03 35 00: Concrete Finishing.
   5. Section 03 35 43: Polished Concrete Finishing.
   6. Division 22: Plumbing.
   7. Division 23: Mechanical.
   8. Division 26: Electrical.

1.3 DEFINITIONS

A. Cementitious Materials:
   1. Portland cement alone or in combination with one or more of the following, subject to compliance with requirements:
      a. Blended hydraulic cement.
      b. Fly ash and other pozzolans.
      c. Ground granulated blast-furnace slag.
      d. Silica fume.

1.4 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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

D. Certificates: Weighmaster's certificates.

E. Material Certificates:
   1. For each of the following, signed by manufacturers:
      a. Cementitious materials.
      b. Admixtures.
      c. Waterstops.
      d. Curing materials.
      e. Floor and slab treatments.
      f. Bonding agents.
      g. Adhesives.
      h. Vapor retarders.
      i. Semi-rigid joint filler.
      j. Joint-filler strips.
      k. Repair materials.

F. Material Test Reports:
   1. For the following, from a qualified testing agency, indicating compliance with requirements:
      a. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
      b. Vapor retarder: Provide third part documentation that all testing was performed on a single production roll and a summary of test results per ASTM E1745.

1.5 QUALITY ASSURANCE

A. Codes and Standards:
   1. Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
      a. CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
      b. American Concrete Institute (ACI) Publications:
         1) Comply with the following unless modified by requirements in the Contract Documents:
            a) ACI 301, "Specifications for Structural Concrete."
            b) ACI 117, "Specification for Tolerances for Concrete Construction and Materials and Commentary."
            c) ACI 302.1R, “Guide to Concrete Floor and Slab Construction.”
            d) ACI 302.2R, “Guide for Concrete Slabs that receive Moisture-Sensitive Flooring Materials.”
            e) ACI 305R, “Guide to Hot Weather Concreting.”
            f) ACI 306R, “Guide to Cold Weather Concreting.”
            g) ACI 318, “Building Code Requirements for Structural Concrete and Commentary.”

B. Manufacturer Qualifications:
   1. A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment:
      a. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Source Quality Control: Furnish Weighmaster’s certificates for all concrete.

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

E. Concrete Testing Service: Engage a qualified independent testing agency approved by DSA to perform material evaluation tests and to design concrete mixtures.

F. Pre-Installation Meeting: Conduct meeting onsite. Include product and material manufacturers.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete:
   1. Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in large sizes to minimize number of joints:
      a. Plywood, metal, or other approved panel materials.
      b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
         1) High-density overlay, Class 1 or better.
         2) Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
         3) Structural 1, B-B or better; mill oiled and edge sealed.
         4) B-B (concrete form), Class 1 or better; mill oiled and edge sealed.

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

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4-inch by 3/4-inch minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent:
   1. Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces:
      a. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties:
   1. Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal:
      a. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60.

B. Welded Reinforcing Bars: Low-alloy-steel reinforcing bars, ASTM A706/A706M, deformed.

C. Do not use reinforcement having any of the following defects:
   1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances.

2. Bends or kinks not indicated on the Drawings or required for this Work.
3. Bars with cross-section reduced due to excessive rust or other causes.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports:
1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
a. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material:
1. Use the following cementitious materials, of the same type, brand, and source, throughout Project:
a. Portland Cement - ASTM C150, Type I/II. Supplement with the following:
1) Fly Ash: ASTM C618, Class F.

B. Normal-Weight Aggregates:
1. ASTM C33:
a. Maximum coarse-aggregate size: Per plan.
b. Fine aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

B. Chemical Admixtures:
1. Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride:
a. Water-reducing admixture: ASTM C494/C494M, Type A.
b. Retarding admixture: ASTM C494/C494M, Type B.
c. Water-reducing and retarding admixture: ASTM C494/C494M, Type D.
d. High-range, water-reducing admixture: ASTM C494/C494M, Type F.
e. High-range, water-reducing and retarding admixture: ASTM C494/C494M, Type G.
f. Plasticizing and retarding admixture: ASTM C1017/C1017M, Type II.

C. Integral Waterproofing Admixtures:
1. ASTM C494, Type S, complex catalyzed hydrous silicate, water and vapor proofing liquid admixture:
a. Product: Subject to compliance with requirements, provide Moxie International Inc.; Moxie Shield 1800 Concrete Admixture, P.O. Box 838 Loomis, CA 95650; Contact Manufacturer’s representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com.
b. Properties:
1) Water/cement ratio: Maximum 0.52.
2) Water vapor transmission: Less than 0.1 perms (5.7 g/Pa-s-m2).

3) Water seepage or permeability: Not to exceed 7.00 x 10-9 cm/s @ 50psi (2.3 x 10-10 ft/s).

2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder:
1. ASTM E1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape:
   a. Products are subject to compliance with requirements. Acceptable products:
      1) Stego Industries, LLC: Stego Wrap 15 mil Class A.
      2) Grace Construction Products: Florprufe 120.
      3) W. R. Meadows, Inc.: Perminator 15 mil.
      4) Substitutions with Architect’s approval, and pursuant to conditions of Divisions 00 and 01.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, Size 57, with 100 percent passing a 1-1/2-inch sieve and zero to five percent (0%-5%) passing a No. 8 sieve.

2.7 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately nine-ounces-per-square-yard when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.8 RELATED MATERIALS

A. Non-Shrink Grout:
1. Factory premixed grout; ASTM C1107.
2. Compressive strength: 7,000 psi at 28 days.

B. Exterior Concrete Walks: Provide a capillary break consisting of two inches (2”) of clean dry sand, ASTM C33, evenly spread on top of the compacted subgrade.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301:
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. All concrete mix designs shall be prepared and stamped by a California registered civil Engineer.

B. Cementitious Materials:
1. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   a. Fly Ash: 15 to 25 percent.

C. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Foundation Walls, Concrete Stairs, and Concrete Walls:
   1. Proportion normal-weight concrete mixture as follows:
      a. Minimum compressive strength: 3,000 psi at 28 days unless otherwise noted.
      b. Maximum water-cementitious materials ratio: 0.55.
      c. Minimum cementitious materials content: 5.5 sacks of cement per cubic yard.
      d. Slump limit: Four inches (4”), plus or minus one inch (1”).

B. Interior Slabs-on-Grade:
   1. Proportion normal-weight concrete mixture as follows:
      a. Minimum compressive strength: 4,000 psi at 28 days.
      b. Maximum water-cementitious materials ratio: 0.45.
      c. Minimum cementitious materials content: Six (6) sacks of cement per cubic yard.
      d. Slump limit: Four inches (4”), plus or minus one inch (1”).

C. Exterior Slabs-on-Grade:
   1. Proportion normal-weight concrete mixture as follows:
      a. Minimum compressive strength: 3,000 psi at 28 days.
      b. Maximum water-cementitious materials ratio: 0.55.
      c. Minimum cementitious materials content: 5.5 sacks of cement per cubic yard.
      d. Slump limit: Four inches (4”), plus or minus one inch (1”).

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete:
   1. Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information:
      a. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 90 minutes to 75 minutes; when air temperature is above 90 degrees F reduce mixing and delivery time to 60 minutes.

2.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment:
   1. Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces:
      a. Basis-of-design product: Subject to compliance with requirements, provide Moxie International Inc.; **Moxie Shield 1500 Concrete Sealer or Moxie Shield MFSII Flooring Sealer**, P.O. Box 838 Loomis, CA 95650; Contact Manufacturer’s representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com.
      b. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 EXECUTION

3.1 FORMWORK

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

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

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

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

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

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. In no case shall any bolt or anchor be stabbed in place while or after the concrete is poured:
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General:
   1. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained:
      a. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
      b. Do not strip vertical concrete in less than seven (7) days.
      c. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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

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

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring:
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Sheet Vapor Retarders:
   1. Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions:
      a. Lap joints six inches (6”) and seal with manufacturer's recommended tape.
      b. Seal all penetrations (including pipes) per manufacturer’s tape.
      c. No penetration of the vapor barrier is allowed except for reinforcing and permanent utilities.
      d. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area six inches (6”) and taping all four sides with tape.
      e. Do not saturate the sand cushion.
      f. If sand is saturated prior to placement of concrete, remove the sand and replace.
      g. Protect all installed moisture barrier construction from precipitation and water penetration by covering and providing positive drainage away from the moisture barrier.
      h. Cover slab openings and block-outs around columns to prevent water penetration of moisture barrier.

3.6 STEEL REINFORCEMENT

A. General:
   1. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement:
      a. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
      b. Clean reinforcement and remove loose dust and mill scale, earth, oil, and other materials that reduce bond or destroy bond with concrete.
      c. Position, support, and secure reinforcement against displacement by forms, construction, and the concrete placement operations. Provide metal chairs, dobies, or other aids manufactured for this purpose.
      d. Place reinforcement to obtain the required concrete coverages for concrete protection.

3.7 JOINTS

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

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

C. Contraction Joints in Slabs-on-Grade:
   1. Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one inch (1”) as follows:
      a. Grooved joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
      b. Sawed joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide, 1/3-inch depth joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Saw cut slab as soon as surface has hardened to where it can support the equipment and operator, normally within two (2) hours after finishing. Use saw designed for cutting fresh concrete, such as “Soff-Cut” or equal.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate 1/2 of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

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

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one (1) layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation:
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least six inches (6”) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete:
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement:
   1. Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures:
      a. When average high and low temperature is expected to fall below 40 degrees F for three (3) successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
      b. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
      c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement:
   1. Comply with ACI 301 and as follows:
      a. Maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
      b. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish:
   1. As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities:
      a. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish:
   1. As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities:
      a. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish:
   1. Apply the following to smooth-formed finished as-cast concrete where indicated:
      a. Smooth-rubbed finish: Not later than one (1) day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
      b. Grout-cleaned finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one-part portland cement to 1-1/2-parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
      c. Cork-floated finish: Wet concrete surfaces and apply a stiff grout. Mix one-part portland cement and one-part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

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

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Except as may be shown otherwise on Drawings, provide the following finishes at the indicated locations.

B. Scratch Finish:
   1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction:
      a. Apply scratch finish to surfaces that are to receive concrete floor toppings or mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:
   1. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low

spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture:
a. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings:
a. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
b. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, ten-foot-long (10') straightedge resting on two (2) high spots and placed anywhere on the surface does not exceed 1/8 inch.
c. Contractor shall anticipate that grinding will be required as a result of curling or other slab defects. Grinding required to bring the slab surface into acceptable tolerances for finished flooring installation shall be included as part of the Work.

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

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

3.11 CONCRETE PROTECTING AND CURING

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

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

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture curing: Keep surfaces continuously moist for not less than seven (7) days.
2. Moisture-retaining-cover curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven (7) days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.12 CONCRETE SURFACE REPAIRS

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

3.13 FIELD QUALITY CONTROL

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

B. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests:
1. Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
   a. Testing frequency: Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding five (5) cubic yards, but less than 25 cubic yards, plus one (1) set for each additional 50 cubic yards or fraction thereof.
   b. Testing frequency:
      1) Obtain at least one (1) composite sample for each 50 cubic yards or fraction thereof of each concrete mixture placed each day, but not less than once for each 2,000 square feet of surface area for slabs or walls:
         a) When frequency of testing will provide fewer than five (5) compressive-strength tests for each concrete mixture, testing shall be conducted from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.
   c. Slump: ASTM C143/C143M; one (1) test at point of placement for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   d. Air content: ASTM C231, pressure method, for normal-weight concrete; one (1) test for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture.
   e. Concrete temperature: ASTM C1064/C1064M; one (1) test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test (1) for each composite sample.
   f. Unit weight: ASTM C567, fresh unit weight of structural lightweight concrete; one (1) test for each composite sample, but not less than one (1) test for each day's pour of each concrete mixture.
   g. Compression Test Specimens:
      1) ASTM C31/C31M:
         a) Cast and laboratory cure two (2) sets of two (2) standard cylinder specimens for each composite sample.
         b) Cast and field cure two (2) sets of two (2) standard cylinder specimens for each composite sample.
   h. Compressive-strength tests:
      1) ASTM C39/C39M; test one (1) set of two (2) laboratory-cured specimens at seven (7) days and one (1) set of two (2) specimens at 28 days:
         a) Test one (1) set of two (2) field-cured specimens at seven (7) days and one (1) set of two (2) specimens at 28 days.
         b) A compressive-strength test shall be the average compressive strength from a set of two (2) specimens obtained from same composite sample and tested at age indicated.
   i. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

j. Strength of each concrete mixture will be satisfactory if every average of any three (3) consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength.
k. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both seven (7) and 28-day tests.
l. Nondestructive testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
m. Additional tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
n. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
o. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 00

SECTION 03 35 00 CONCRETE FINISHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Deep penetrating concrete floor sealer.
   2. Accessories necessary for a complete installation

B. Related Sections:
   1. Section 03 20 00: Concrete Reinforcing.
   2. Section 03 30 00: Cast-In-Place Concrete.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, application instructions, and recommendations. Include data substantiating product complies with requirements of the Contract Documents.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for interior finishes in 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA).

B. Accessibility Requirements:
   1. Comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.
      b. 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA).
      c. CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

C. Manufacturer Qualifications: Provide products produced by a company specializing in production of concrete sealers for minimum of five (5) years.

PART 2 PRODUCTS

2.1 MATERIAL

A. Concrete Sealer: Deep penetrating sealer, water based, clear, non-yellowing, nontoxic, VOC compliant concrete sealer, integral with concrete through chemical reaction forming nonsoluble seal within pores and capillaries of concrete and sealing it against ingress of moisture while allowing concrete to breathe.

B. Basis of Design:

1. Product: Subject to compliance with requirements, provide **Moxie International Inc.; Moxie Shield 1500 Concrete Sealer**, P.O. Box 838 Loomis, CA 95650; Contact Manufacturer's representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com.
   a. PROSOCO, Inc.
   b. W.R. Meadows.

C. Physical Properties:
1. Permeability: Maximum 0.093 ml/m^2/s.
2. Specific gravity: 1.094.
3. PH: 11.50.
4. Flash point: Nonflammable.
5. Chemical identity: Mixture containing silicates, bonding catalysts, and inert materials.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Requirements: Do not proceed with installation until areas to receive work are enclosed and temperature and relative humidity are stabilized and maintained for optimum quality control.

B. Environmental Limitations:
1. Comply with coating manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and conditions affecting floor treatment application. Do not apply coating until wet work in spaces is complete and dry; and overhead work, including installing mechanical systems, lighting, and athletic equipment, is complete:
   a. Apply floor coatings when substrate temperature and surrounding air temperatures are between 50 degrees F and 95 degrees F (10 degrees C and 35 degrees C).
   b. Do not apply floor coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

3.2 EXAMINATION

A. Examine substrates for conditions affecting performance and conditions of floor treatment:
1. Verify compatibility with and suitability of substrates, including existing finishes or primers.
2. Verify plasticizers in existing concrete substrate will not impair bond.
3. Proceed with installation after correcting unsatisfactory conditions

3.3 PREPARATION

A. Clean substrate, removing projections and substances detrimental to the work; comply with recommendations of manufacturer of products to be installed for proper preparation procedures. Mask off or protect adjacent surfaces not scheduled to receive sealer.

3.4 APPLICATION

A. Spray apply sealer to comply with manufacturer's instructions except where Project conditions require extra precautions or provisions to ensure satisfactory performance of the Work:
1. Apply sealer to produce surface without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections. Produce sharp glass lines and

color breaks.

3.5 CLEANING

A. After completing application, clean spattered surfaces. Remove spattered sealer by washing or other appropriate methods for coating. Do not scratch or damage adjacent finished surfaces.

B. Clean Up: Remove rubbish, empty cans, rags, and discarded materials from site daily. Rinse and recycle or legally dispose of sealer and coating containers.

3.6 PROTECTION

A. Institute protective procedures and install protective materials as required to ensure that work of this Section will be without damage or deterioration at substantial completion.

END OF SECTION 03 35 00

SECTION 03 35 43 POLISHED CONCRETE FINISHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Polished concrete finishing.
   2. Staining.
   3. Scoring.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product including special concrete finishes, data sheets, and manufacturer’s installation instructions.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples: Submit samples of each type of exposed color showing anticipated variegation of color.

D. Test Reports: Submit test reports or certification from NFSI confirming that polished concrete floor finish has been tested and has passed phase 2 level of certification.

E. Qualification Data: Submit one (1) copy of installer’s qualifications.

F. Material Certificates:
   1. Submit materials certificates signed by manufacturer for the following products:
      a. Repair materials.
      b. Stain materials.
      c. Liquid floor treatments.

G. Maintenance Data: Submit manufacturer's recommended cleaning and maintenance instructions for polished concrete floor finish.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for interior finishes in 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA).
   2. Americans with Disabilities Act of 1990, as amended:
      a. ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
      b. 2022 California Building Code (CBC) Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

B. Manufacturer Qualifications: Provide products produced by a company specializing in production of special concrete finishes concrete for minimum of five (5) years.

C. Installer Qualifications: Installer having minimum five (5) years' documented experience, who specializes in the finishing of concrete substrates, and who is certified by manufacturer as an installer of special concrete finishes.

D. Field Sample Panels:
   1. After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three (3) sets of full-scale panels, approximately 48 inches by 48 inches (1,200 mm x 1,200 mm) minimum, to demonstrate the expected range of finish, color, and appearance variations:
      a. Locate panels as indicated, or if not indicated, as directed by Architect.
      b. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
      c. Demolish and remove field sample panels when directed.

E. Mockups:
   1. Before casting concrete, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
      a. Build mockups in the location and of the size indicated, or if not indicated, as directed by Architect.
      b. Demonstrate curing, finishing, and protecting of polished concrete.
      c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Pre-Installation Conference:
   1. Conduct conference at site. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready mix concrete manufacturer.
      d. Cast-in-place concrete Subcontractor.
      e. Polished concrete finishing Subcontractor.

G. Review cold and hot weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage.

B. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

PART 2 PRODUCTS

2.1 POLISHING

A. Final Polished Concrete Floor Finish: CPC Class [A – Cement Fines; 85 to 95 percent cement fines, 5 to 15 percent fine aggregate.] [B - Fine Aggregate; 85 to 95 percent fine aggregate, 5 to 15 percent blend of cement fines and coarse aggregate.] [C - Coarse Aggregate; 80 to coarse aggregate; cement fines, 10 to 20 percent blend of cement fines and fine aggregate.]

B. Apply one coat of undiluted densifier solution to point of rejection, remove excess liquid, and allow to cure according to manufacturer's instructions.

C. Re-apply one additional coat of undiluted densifier solution to point of rejection, remove excess liquid, and allow to cure according to manufacturer's instructions.

D. Fill surface imperfections using surface repair products such that imperfections are not noticeable when viewed from 5 feet away under lighting conditions that will be present after construction.

E. Apply grout as required to form continuous monolithic surface.

F. Final Concrete Floor Gloss:
   1. CPC Level [1 – Flat, image clarity value 0 to 9 percent, haze index less than 10] [2 – Satin; image clarity value 10 to 39 percent, haze index less than 10.] [3 – Polished; image clarity value 40 to 69 percent, haze index less than 10.] [4 – Highly Polished; image clarity value 70 to 100 percent, haze index less than 10.]
   2. Test image clarity value to ASTM D5767 and haze to ASTM D4039 prior to application of sealer, at rate of three tests per 1000 square feet of polished concrete.

G. Final Surface: Abrasion and scratch free, uniform in appearance.

2.2 MATERIALS

A. Densifying and Sealing Treatment:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Dayton Superior.
      b. Laticrete: FGS Permashine.
      c. W.R. Meadows: Liqui-Hard.
      d. Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.

B. Reactive Stain:
   1. Acidic based stain with wetting agents and high grade, UV stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects:
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) Bomanite Co.
         2) Increte Systems Inc.
         3) Scofield, L. M. Company.
         4) Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.

C. Penetrating Stain:
   1. Water based, acrylic latex, penetrating stain with colorfast pigments:
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:

1) Bomanite Co.
2) Scofield, L. M. Company.
3) SuperStone, Inc.
4) Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.

D. Penetrating Liquid Floor Treatments for Polished Concrete Finish:
1. Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; and that penetrates, hardens, and is suitable for polished concrete surfaces:
a. Manufacturers are subject to compliance with requirements. Provide products by one of the following:
1) Moxie International.
2) Euclid Chemical Company (The); a RPM company.
3) L&M Construction Chemicals, Inc.
4) Vexcon Chemicals Inc.
5) Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic necessary for other construction activities.

B. Environmental Limitations:
1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and conditions affecting topping performance.
2. Concrete Flatness:
a. Floor Flatness Rating: Minimum FF 40.
b. Floor Levelness Rating: Minimum FL 40.
3. Curing: Minimum of 28 days or as directed by the manufacturer before application.
4. Apply stain minimum ten (10) days prior to installation of equipment and Substantial Completion, ensuring uninhibited concrete slab.
5. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

3.2 EXAMINATION

A. Examine substrate for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work:
1. Verify that slab complies with finish and surface profile requirements.
2. Prior to application, verify concrete floor surfaces are free of laitance and construction materials.
3. Verify concrete has been in place a minimum of 28 days prior to the commencement of application.
4. Do not proceed until unsatisfactory conditions are corrected.

3.3 PREPARATION

A. Deliver materials to site in original, factory sealed, unopened, new containers bearing manufacturer's name and label intact and legible, with the following information:
1. Name or title of material.

2. Manufacturer's standard container drum numbers.
3. Thinning instructions.
4. Application instructions.

B. Storage:
1. Store materials in protected and well-ventilated area at temperatures between 40 degrees F and 90 degrees F unless otherwise required by manufacturer:
a. Keep containers sealed until ready for use.
b. Do not use materials beyond manufacturer's shelf life limits.

C. Existing Concrete:
1. On existing concrete substrates, remove mastics, adhesives, paint, and foreign matter:
a. Clean concrete surfaces free of dirt, debris, paint/oil splatters and other residue.
b. Remove curing compounds and sealers from concrete surfaces.
c. Leave concrete surfaces clean and dry, ready for polishing process.
d. Protect adjacent surfaces and finishes from damage by concrete polishing procedures.
e. Fill control joints and shave prior to grinding and polishing.

D. New Concrete: Verify new concrete has been in place for a minimum of 30 days.

3.4 STAINING

A. Prepare surfaces according to manufacturer's written instructions and as follows:
1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry. Do not use acidic solutions to clean surfaces.
2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
3. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid resistant nylon bristle brushes until bubbling stops and concrete surface has texture of 120 grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
4. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F710 to ensure pH is between seven and eight (7 - 8).

B. Score decorative jointing in concrete surfaces 1/16 inch (1.6 mm) deep with diamond blades to match pattern indicated. Rinse until water is clear. Score after staining:
1. Joint Width: 3/8 inch (10 mm).

C. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D4263 by tightly taping 18-inch by 18-inch (450 mm x 450 mm), 4 mil (0.1 mm) thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

D. Reactive Stain:
1. Apply reactive stain to concrete surfaces according to manufacturer's written instructions and as follows:
a. Apply stain by uncolored bristle brush, roller, or high volume, low pressure sprayer and immediately scrub into concrete surface with uncolored, acid resistant nylon bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to

obtain color consistent with approved mockup.
b. Remove stain residue after four (4) hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.

E. Penetrating Stain:
1. Apply penetrating stain to concrete surfaces according to manufacturer's written instructions and as follows:
a. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
b. Allow to dry four (4) hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
c. Rinse until water is clear. Control, collect, and legally dispose of runoff.

3.5 PREPARATION

A. Cover and protect merchandise and racking to prevent damage or contamination of stored products. Provide dust drapes as required to protect merchandise from dust or debris.

B. Close areas to traffic during and after floor finish application for time period recommended by hardener/densifier manufacturer.

C. Cleaning Substrate:
1. Remove curing, sealing and coating agents, oil, breaking compound residue, wax, and grease by scraping off heavy deposits mechanically or chemically to assure penetration of product into surface:
a. Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water.
b. Remove dust and loose material by brushing, sweeping, vacuuming, and blowing with high pressure air.
c. Remove paint residue with solvent/stripper, provided the stripper does not have an acidic pH.
d. Remove tire marks and residue with recommended non-acidic cleaning agents:
1) Comply with manufacturer’s detailed instructions prior to mixing and removal.
2) Dilute cleaning agent in recommended proportions to avoid etching concrete and opening of concrete pores.
e. Power scrub and rinse floor surface to remove soap residue and contaminants.
f. Squeegee dry.
g. No hazardous, flammable, toxic, or solvent based cleaning materials are permitted.

D. Grind protrusions flush with surface. Patch voids, holes, and cracks with recommended cementitious patching compound compatible with floor finish.

E. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and contaminants.

F. Protect surrounding and adjacent surfaces in accordance with floor finish manufacturer’s written recommendations. Do not apply tape to the floor.

3.6 POLISHING

A. Apply concrete polishing in accordance with manufacturer's instructions to the selected sheen level:
1. Polish:
a. Level 1: Matte finish, 100 grit
b. Level 2: Low sheen, 400 grit

c. Level 3: High sheen, 800 grit
d. Level 4: Gloss shine, 3,000 grit.

B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup:
1. Grind concrete floor to within five inches (5”) of walls and partitions using SF-40 grit, removing construction debris and floor slab imperfections and imparting a uniform scratch pattern in concrete surfaces. Thoroughly vacuum floor using a squeegee vacuum attachment to completely remove dust and debris.
2. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
3. Apply liquid densifier and/or reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
4. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time, approximately two (2) hours, between successive coats. Remove excess material from surfaces.
5. Grind concrete floor to within five inches (5”) of walls and partitions using metal bonded diamond grits in a finer grit for each polishing, grinding 90 degrees from each previous grind and removing scratches from each previous grind. After each grind, thoroughly vacuum floor using a squeegee vacuum attachment to completely remove dust and debris.
6. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
7. Continue polishing with progressively finer grit diamond polishing pads to gloss level, to match approved mockup.
8. Control and dispose of waste products produced by grinding and polishing operations.
9. Neutralize and clean polished floor surfaces.

C. Completed polished concrete floor shall have uniform sheen level and shall match accepted mock-up.

END OF SECTION 03 35 43

SECTION 03 35 47 CONCRETE FLOOR SLAB MOISTURE CONTROL SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, furnishing, installing, and testing of systems for control of moisture vapor and pH for concrete slabs to receive moisture-sensitive finish floor coverings, and isolated insulation for thermal breaks.

B. Related Sections:
1. Section 03 30 00: Cast-In Place Concrete.
2. Section 03 35 00: Concrete Finishing.
3. Section 03 53 00: Concrete Topping.

C. Reference Standards:
1. ASTM F3010 Standard Practice for Two-Component Resin Based Membrane- Forming Moisture Mitigation Systems for Use Under Resilient Floor Covering.
2. ASTM C1583 Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
3. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring, where applicable.
4. ICRI Guide 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

D. Review:
1. Special inspection and testing and inspecting agency procedures for field quality control.
2. Concrete finishes and finishing.
3. Cold and hot weather concreting procedure.
4. Curing procedures.
5. Construction contraction and isolation joints, and joint fillers strips.
6. Methods for achieving specified floor and slag flatness and levelness.
7. Concrete repair procedure and concrete protection.

1.3 SUBMITTALS

A. Product Data:
1. Submit manufacturer’s data sheets and supporting information for each product and process specified including:
   a. Product specifications.
   b. Installation instructions.
   c. Manufacturer’s certification that moisture vapor control products meet requirements of current version of ASTM F3010.
   d. Independent test reports supporting product manufacturer’s certificate of conformance to ASTM F3010.
   e. Completed manufacturer’s pre-installation checklist.
   f. Warranty information.

B. Moisture Tests: Submit concrete floor moisture test results required by floor covering manufacturer.
   1. Perform moisture testing as described in ASTM Practice F710.
   2. Testing shall be performed according to the floor covering manufacturer's specified ASTM Standard Test Method by an independent testing agency.
   3. Testing shall be performed by ICRI Tier 2 certified moisture testing technician.
   4. Provide moisture test results to Architect, Owner, General Contractor, and moisture vapor control system manufacturer's representative.

1.4 QUALITY ASSURANCE

A. Codes and Standards:
   1. Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
      a. CBC 2022 California Building Code (CBC).
      b. American Concrete Institute (ACI) Publications:
         1) Comply with the following unless modified by requirements in the Contract Documents:
            a) ACI 301, "Specifications for Structural Concrete."
            b) ACI 117, "Specification for Tolerances for Concrete Construction and Materials and Commentary."
            c) ACI 302.1R, “Guide to Concrete Floor and Slab Construction.”
            d) ACI 302.2R, “Guide for Concrete Slabs that receive Moisture-Sensitive Flooring Materials.”
            e) ACI 305R, “Guide to Hot Weather Concreting.”
            f) ACI 306R, “Guide to Cold Weather Concreting.”
            g) ACI 318, “Building Code Requirements for Structural Concrete and Commentary.”
   2. Floor leveling to be FF50 (Minimum FF35, approval by Architect) and tested per ASTM E1155 following ACI 117 using 3D laser imaging to meet requirement unless otherwise noted ono Drawings.

B. Qualifications of Applicator:
   1. Employ an applicator trained and currently approved by the moisture vapor control system manufacturer, experienced in surface preparation and application of the products of this Section, and subject to observation by the manufacturer.
   2. Submit list of at least three (3) similar projects performed by the applicator within the previous five (5) years that used the same products and similar moisture vapor control system design.

C. Manufacturer’s Qualifications:
   1. Manufacturer shall have not less than ten (10) years’ experience in manufacturing moisture vapor control systems. The moisture vapor control system must be specifically formulated and marketed for concrete floor slab moisture vapor control and pH control.
   2. Provide manufacturer’s standard 25-year warranty at no additional cost. Applicator of moisture vapor control system shall provide standard installation warranty for workmanship.

D. Mockup:
   1. Install the moisture control system in a minimum 100 square foot mockup area, using the same methods and equipment that will be used for the entire installation.
   2. Test tensile bond strength of the moisture mitigation system to the concrete substrate following ASTM D7234.
   3. The results must be equal to or greater than 200 psi with failure in the concrete before proceeding with installation of the moisture control system.

4. Include isolated rigid insulation noted on drawing details.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the Ready Mixed Concrete Production Facility in original unopened containers, clearly labeled with the manufacturer's name and brand designation. Each container shall be marked with batch or lot code traceable to manufacturing information.

B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sunlight. Product shall not be stored in areas with temperatures in excess of 90 degrees F or below 50 degrees F unless permitted by manufacturer’s instructions.

C. Handle products using methods that prevent breakage or damage of containers and prevent contamination of products.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Moisture vapor control system shall be the product of a single manufacturer.

B. Basis of Design:
   1. **Moxie International,** P.O. Box 838 Loomis, CA 95650; Contact Manufacturer’s representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com. Penetrating Concrete Floor Treatment:
      a. Moxie Shield 2000 Concrete Patch.
      b. Moxie Shield 1800 Waterproofing Admixture.
      c. Moxie Shield 1500 Concrete Sealer.
      d. Moxie Shield 1400 Concrete Sealer.

C. Approved equal per Section 01 25 00: Submission Procedures and Form.

2.2 MATERIALS

A. Product:
   1. Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces:
   2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

PART 3 EXECUTION

3.1 PROJECT SITE CONDITIONS

A. Environmental Conditions:
   1. Do not apply topical moisture control system to surfaces that may be exposed to uncontrolled weather conditions such as precipitation, wind, direct sunlight, etc. Do not apply when moisture is accumulated on the surface of the concrete or if precipitation is anticipated before the moisture control coating has cured.
   2. Do not apply moisture control system when temperature is lower than 50 degrees F or higher than 90 degrees F or expected to fall outside this temperature range within 24 hours after application. Do not apply moisture vapor control coating when temperature

is above 80 degrees F and rising or expected to rise during curing period of the moisture control coating.

B. Protection:
1. Protect moisture vapor control system after installation to prevent damage from topical moisture, direct sunlight, and construction traffic for a minimum period of 24 hours after application.

3.2 SCHEDULING

A. The independent testing agency will coordinate scheduling with Owner for moisture testing to permit sufficient time to test, submit and evaluate test results, and install the moisture vapor control system before installation of floor coverings.

B. The moisture vapor control system manufacturer's instructions must allow installation as early as seven (7) days after concrete placement.

3.3 EXAMINATION OF SUBSTRATE BEFORE INSTALLATION OF TOPICAL

A. Provide information required in moisture control system manufacturer's pre-job checklist.
1. Submit completed checklist to moisture control system manufacturer for review before installation of the moisture control system.

B. Test concrete floor slab moisture prior to application of moisture control system:
1. If moisture testing is performed, moisture testing shall be conducted according to the latest version of ASTM F2170 using relative humidity probes that have been allowed to equilibrate at each test location for at least two (2) hours. Provide report in accordance with ASTM F2170 and floor plan showing moisture test results.

C. Testing and evaluation for deleterious materials and contaminants that inhibit moisture control coating adhesion:
1. It is the responsibility of Owner to provide a concrete floor slab free of contaminants and deleterious materials that can inhibit bond to the moisture control coating or develop deleterious reactions after the concrete floor slab is sealed.
2. Concrete substrates must be structurally sound, solid, and meet industry standards as defined in ACI Committee 201 Report "Guide to Durable Concrete." Surfaces must be free of moisture-sensitive patching and leveling materials, adhesives, coatings, curing compounds, concrete sealers, efflorescence, dust, grease, oils, and any other materials or contaminants that can act as bond breakers.
3. The floor slab surface must be capable of withstanding steel shotblast preparation to ICRI CSP3. Excessively weak, soft, dusty, cracked, or uneven surfaces may not be suitable substrates, and may require additional concrete surface removal or patching before application of the moisture control coating. Such compounds must be long term resistant to high moisture and high pH.
4. Contaminated concrete may not be suitable to receive a moisture control coating. Testing and evaluation for contaminants and concrete condition is not required but is strongly recommended. Testing and evaluation of the floor slab can include:
   a. Solvent extraction and analysis for organic compounds such as oil, grease, plasticizers, silicones, solvents, and other chemical compounds that can inhibit bond to the epoxy moisture control coating.
   b. Microscopical (petrographic) examination according to ASTM C856 to evaluate the concrete condition, potential deleterious substances, and suitability for shot blasting and coating adhesion.
5. Do not install moisture control system if substrate testing reveals unacceptable conditions.

3.4 SURFACE PREPARATION FOR TOPICAL

A. Spread moisture control coating using manufacturer's recommended process. Completely cover the entire concrete surface with a uniform application of the moisture control coating as quickly as possible and allow the coating to self-level. Work into a wet edge and assure continuity of the coating across the entire area.

B. Remove existing floor finishes including floor coverings, coatings, paint, and adhesives. Follow RFCI Recommended Work Practices for the Removal of Resilient Floor Coverings.

C. Abrasive Surface Preparation:
   1. Grind perimeter of rooms and areas inaccessible to shot blasting using dry diamond media with vacuum dust extraction. Grind to ICRI CSP2. Do not smooth polish these areas. Grinding is allowed only in areas not accessible to shot blasting.
   2. Shot blast floors to ICRI CSP3. Shot blast as close as possible to walls, doorways, casework, and other permanently installed objects. Remove residual steel shot.
   3. Acid etching is not permitted.

D. Remove residual dust and debris by vacuum and dry sweeping. Do not use sweeping compound. Remove all foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, shot blast beads, etc.

E. Test concrete surface tensile strength after abrasive preparation in accordance with requirements of ASTM F3010 following Test Method C1583. If test results are less than 200 psi, repair concrete or repeat surface preparation to achieve required concrete surface tensile strength.

F. Repair non-movement cracks, control joints, and large surface defects such as spalls, holes, and voids in accordance with manufacturer's recommendations. Use low-viscosity, gravity fed crack mending resin for non-movement cracks and joints. Crack repair compound can be mixed with not more than three-parts clean, washed, dry silica sand for sawcut control joints and wide cracks. Brush interior walls of crack or joint with neat crack repair epoxy resin before applying sand-resin mixture. After curing, grind surface flush with surrounding concrete.

G. Repair spalls or excessively rough concrete surface using manufacturer's fiber thickening agent mixed 1:1 by volume with moisture control resin. Mix thickening agent and resin thoroughly to uniform creamy consistency and apply by trowel, working material tightly against clean, roughened concrete surface.

H. Do not fill designed movement joints with moisture control epoxy resin. Fill movement joints with manufacturer's recommended flexible joint filling compound or mechanical movement joint cover.

I. Reinforcing fibers that become visible after shot blasting must be removed and vacuumed leaving no fibers exposed above the concrete surfaces. Provide an uncontaminated, clean, sound surface.

3.5 MIXING WATERPROOFING ADMIXTURE

A. Mix moisture control thoroughly for three (3) minutes in manufacturer supplied containers following manufacturer's requirements to obtain a homogeneous mixture. Use a low speed motor less than 400 rpm and a two-bladed Jiffy-type mixing blade only. Do not aerate.

B. If smaller quantities are required, maintain manufacturer's specified mix ratios by volume.

C. Do not dilute with solvent.

3.6 APPLICATION

A. After mixing, immediately pour material in concrete batch. Empty can completely. Do not invert can or drain on exposed finish concrete.

3.7 INSPECTION

A. Inspect cured topical moisture control coating for complete, uniform coverage. Note any defects to be repaired such as pinholes, bubbles, or thin spots.

B. Repair or install additional coats as necessary to produce a uniform, flat, smooth coating surface that meets manufacturer's minimum thickness requirements in all areas.

C. Test topical adhesion of the moisture control coating to the concrete substrate as required in ASTM F3010 following Test Method D7234. Tensile bond strength of the coating must be at least 200 psi with failure in the concrete. Repair or replace areas that do not meet this requirement.

3.8 CLEANING

A. Clean tools and equipment in contact with epoxy resins using xylene or other suitable cleaning agent immediately after use.

B. Remove debris and unused materials from Project site. Dispose chemicals, rags, and other materials in accordance with applicable regulations and specific jobsite instructions.

3.9 PROTECTION

A. Protect applications of the moisture control system during the specified cure period from traffic, topical moisture, and contaminants.

B. Protect installed cementitious underlayment or skim coat until floor covering installation.

END OF SECTION 03 35 47

SECTION 03 53 00 CONCRETE TOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Emery aggregate concrete floor topping.
   2. Accessories necessary for a complete installation.

B. Pre-Installation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: Submit technical data, substrate preparation, and installation instructions.

B. Product Test Reports: For each concrete floor topping, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Field quality control test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C1077 and ASTM E329 for testing indicated.

B. Mockups:
   1. Place concrete floor topping mockups to demonstrate typical joints, surface finish, bonding, texture, tolerances, and standard of workmanship:
      a. Build mockups approximately 100 square feet (9.3 sq. m) in the location indicated or, if not indicated, as directed by Architect.
      b. If Architect determines that mockups do not meet requirements, demolish and remove them from the site and cast others until mockups are approved.
      c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

PART 2 PRODUCTS

2.1 MATERIALS

A. Emery Aggregate Concrete Floor Topping:
   1. Factory prepared and dry packaged mixture of graded, crushed emery aggregate containing not less than 50 percent aluminum oxide, not less than 24 percent ferric oxide, and not more than eight percent (8%) silica; portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at site:
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) L&M Construction Solutions; Emerytop 400. Basis of Design.
         2) US Concrete Materials, LLC.
         3) Dayton Superior.
         4) Substitutions with Architect's approval, pursuant to conditions of Divisions 00 and 01.
   2. Compressive Strength (28 Days): 10,000 psi (69 MPa); ASTM C109/C109M.

B. Curing Materials:
   1. Evaporation retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
   2. Absorptive cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard (305 g/sq. m) when dry.
   3. Moisture retaining cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
   4. Water: Potable.
   5. Clear, waterborne, membrane forming curing compound: ASTMC309, Type 1, Class B, 25 percent solids content, minimum.

C. Related Materials:
   1. Semi rigid joint filler: Two-component, semi rigid, 100 percent solids epoxy resin with a Type A Shore durometer hardness of 80 or aromatic polyurea with a Type A Shore durometer hardness range of 90 to 95 according to ASTM D2240.
   2. Joint filler strips: ASTM D1751, asphalt saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
   3. Portland cement: ASTM C150/C150M, Type I or II.
   4. Sand: ASTM C404, fine aggregate passing No. 16 (1.18 mm) sieve.
   5. Water: Potable.
   6. Acrylic bonding agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
   7. Epoxy adhesive: ASTM C881/C881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.
   8. Power actuated fasteners: Fastener systems with an evaluation report based on ICC-ES AC70.

2.2 MIXING

A. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Environmental Limitations:
   1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance:

a. Place concrete floor topping only when ambient temperature and temperature of base slabs are between 50 degrees F and 86 degrees F (10 degrees C and 30 degrees C).

B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

3.2 EXAMINATION

A. Examine substrates or conditions affecting performance of the work.

B. Verify base concrete slabs comply with scratch finish requirements specified in Section 03 30 00: Cast-In-Place Concrete.

C. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D4263.

D. Proceed with application after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Existing Concrete:
1. Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch (6 mm):
   a. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
   b. Mechanically remove contaminants from existing concrete that might impair bond of floor topping.
   c. Saw cut contraction and construction joints in existing concrete to a depth of 1/2 inch (13 mm) and fill with semi-rigid joint filler.

B. Install joint filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated:
1. Extend joint filler strips full width and depth of joint, terminating flush with topping surface unless otherwise indicated.
2. Terminate full width, joint-filler strips 1/2 inch (13 mm) below topping surface where joint sealants, specified in Section 07 92 00: Joint Sealants are indicated.
3. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

C. Install power actuated fasteners according to written directions of floor topping manufacturer at perimeter of areas that are to receive floor topping, including both edges of locations where joints will be formed in floor topping.

3.4 FLOOR TOPPING APPLICATION

A. Start floor topping application in presence of manufacturer's technical representative.

B. Monolithic Floor Topping: After textured float finish is applied to fresh concrete of base slabs specified in Section 03 30 00: Cast-In-Place Concrete, place concrete floor topping while concrete is still plastic.

C. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of 1/16 inch to 1/8 inch (1.6 mm - 3 mm), without

puddling. Place floor topping while slurry is still tacky.

D. Existing Concrete: Apply epoxy bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 inch to 1/8 inch (1.6 mm - 3 mm), without puddling. Place floor topping while adhesive is still tacky.

E. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip:
   1. Screed surface with a straightedge and strike off to correct elevations.
   2. Slope surfaces uniformly where indicated.
   3. Begin initial floating, using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

F. Finishing:
   1. Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture:
      a. Hard trowel finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture:
         1) Finish surfaces to specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15, and notify independent testing agency to permit measurement within 24 hours according to ASTM E1155 for a randomly trafficked floor surface.
         2) Finish and measure surface, so gap at any point between surface and an unleveled freestanding ten foot (3 m) long straightedge, resting on two (2) high spots and placed anywhere on the surface, does not exceed 1/4 inch (6 mm).

G. Construction Joints:
   1. Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect:
      a. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.

H. Contraction Joints:
   1. Form weakened plane contraction joints with power saws equipped with shatterproof abrasive or diamond rimmed blades. Cut 1/8 inch (3 mm) wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop:
      a. Form joints in concrete floor topping over contraction joints in base slabs unless otherwise indicated.
      b. Construct contraction joints for a combined depth equal to topping thickness and not less than 1/4 of base slab thickness.
      c. Construct contraction joints for a depth equal to 1/2 of concrete floor topping thickness, but not less than 1/2-inch (13 mm) deep.

3.5 PROTECTING AND CURING

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

B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.

C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:
   1. Moisture curing: Keep surfaces continuously moist for not less than seven (7) days with water, continuous water fog spray or absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch (300 mm) lap over adjacent absorptive covers.
   2. Moisture retaining cover curing: Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven (7) days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   3. Curing compound: Apply uniformly in two (2) coats in continuous operations by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.6 JOINT FILLING

A. Prepare and clean contraction joints and install semi rigid joint filler, according to manufacturer's written instructions, once topping has fully cured.

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

C. Install semi rigid joint filler full depth of contraction joints. Overfill joint and trim semi rigid joint filler flush with top of joint after hardening.

3.7 REPAIR

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services:
   1. Testing and inspecting of completed applications of concrete floor toppings shall take place in successive stages, in areas of extent and using methods as follows:
      a. Sample sets: At point of placement, a set of three (3) molded-cube samples shall be taken from the topping mix for the first 1,000 square feet (93 sq. m), plus one (1) set of samples for each subsequent 5,000 square feet (464 sq. m) of topping, or fraction thereof, but not less than six (6) samples for each day's placement. Samples shall be tested according to ASTM C109/C109M for compliance with compressive-strength requirements.
      b. Concrete floor topping shall be tested for delamination by dragging a steel chain over the surface.
      c. Concrete floor topping shall be tested for compliance with surface flatness and

levelness tolerances.

C. Remove and replace applications of concrete floor topping where test results indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 03 53 00

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
1. Coordinate the work of this Section with related trades.
2. Verify applicable dimensions, clearances, and heights at the jobsite.
3. Furnish materials and perform labor required to execute this work as indicated on the Drawings, as specified herein, and as necessary to complete the work required by Project conditions, including but not limited to:
   a. Structural steel.
   b. Architectural steel.
   c. All cast-in-place bolts, nuts, plates, etc.
   d. Ten-gauge steel or 3/4-inch plywood templates for column anchor bolts.
   e. Field filling of holes in steel beams and columns.
   f. Field preparation, priming, and finish painting of all exposed exterior steel:
      1) Field preparation, priming, and painting of interior exposed steel, including but not limited to:
         a) Structural steel.
         b) Exposed columns, beams, etc.
         c) Refer to Section 09 90 00: Painting and Coating and Drawings.
      2) Field preparation, priming, and painting of exterior exposed steel, including but not limited to:
         a) Structural steel.
         b) Exposed columns, beams, etc.
         c) Refer to Section 09 90 00: Painting and Coating and Drawings.

B. Related Sections:
1. Section 01 74 19: Construction Waste Management and Disposal.
2. Section 03 30 00: Cast-In-Place Concrete.
3. Section 09 90 00: Painting and Coating.

C. Reference Standards:
1. 2022 California Code of Regulations (CCR), Title 24, California Building Standards Commission (CBSC) www.bsc.ca.gov current edition at time of permit issuance:
   a. (CCR) Title 24, (CBSC) Chapter 11 – California Green Building Standards Code:
      1) Non-residential new construction:
         a) All occupancy types.
         b) First time tenant improvements.
2. 2010 ADA Standards.
3. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines, current version.
4. Refer to Specifications, including, but not limited to California Building Codes. Associations, Standards, Definitions, and Miscellaneous Requirements.
5. American Institute of Steel Construction (AISC):
   a. AISC Steel Construction Manual, including, but not limited to:
      1) Specification for Structural Steel Buildings, most current edition.
      2) RCSC Specification for Structural Joints.

3) Code of Standard Practice for Steel Buildings and Bridges.
b. AISC Specifications for Architecturally Exposed Structural Steel.
c. AISC 303.
d. AISC 360.

6. American Society For Testing and Materials (ASTM):
   a. ASTM A6 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
   b. ASTM A36 Standard Specification for Carbon Structural Steel.
   c. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; Types E or S, Grade B.
   d. ASTM A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
   e. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
   f. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   g. ASTM A327 Standard Test Methods for Impact Testing of Cast Irons.
   h. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; Grade B.
   i. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts.
   j. ASTM A992 Standard Specification for Structural Steel Shapes.
   k. ASTM E23 Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
   l. ASTM E94 Standard Guide for Radiographic Examination Using Industrial Radiographic Film.
   m. ASTM E164 Standard Practice for Contact Ultrasonic Testing of Weldments.
   n. ASTM F436 Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
   o. ASTM F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series.
7. American Welding Society (AWS):
   a. AWS Standard Code for Arc and Gas Welding in Building Construction.
8. Welding Procedures Specifications (WPS).
9. Steel Structures Painting Council (SSPC).

1.3 SUBMITTALS

A. Refer to Section 01 33 00: Submittal Procedures and Section 01 25 00: Substitution Procedures and Form.

B. Submit Manufacturer’s Data and Shop Drawings:
   1. Product data: Include laboratory test reports and other data to show compliance with Specifications (include specified standards). Include certified copies of mill reports covering chemical and physical properties of each type of structural steel.
   2. Shop drawings:
      a. Shop drawings shall include, but not be limited to:
         1) Complete details for fabrication and assembly of structural steel members, procedures, and diagrams.
         2) Complete schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
         3) Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
         4) Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage’s to be installed by others.
      b. Dimensions required for locating structural steel for manufactured items such as mechanical equipment, electrical equipment, dock levelers, etc., shall be

coordinated and provided by the General Contractor. General Contractor shall also coordinate and provide dimensions to locate structural steel for window or equipment supports.

C. Submit Procedures:
1. Provide weld procedures for both pre-qualified welds and special welds to be submitted to the Owner's testing laboratory and the Architect. All Group 4 and 5 shapes and plates greater than two inches (2") shall have additional weld procedures and pre-qualification by testing prior to fabrication.
2. Provide installation procedure and inspection for direct tension indicator washers detailed in supplemental specifications provided by the manufacturer for approval.
3. Procedures shall be submitted for both shop and field welds.
4. Written description of preparation, priming, and finish painting of steel.

D. Compliance Letter Pertaining to Primer and Painting of Steel, Extent of Work, Products, etc.:
1. Refer to Section 09 90 00: Painting and Coating.

E. Coordination:
1. The following shall be provided; including, but not limited to:
a. General Contractor, floor framing fabricator, floor framing Installer, roof framing fabricator, roof framing installer, metal decking installer, and mechanical contractor shall coordinate the size/dimensioning and extent of all roof and floor openings for mechanical equipment, ductwork, and shafts as part of their submittal to the design team.

1.4 QUALITY ASSURANCE

A. Refer to Section 01 40 00: Quality Requirements.

B. AISC Group 4 and 5 shapes and built up members shall meet the requirements for joints in AISC Sections J1.7, J1.8, J2.6, and M2.2.

C. All steel to be exposed and painted shall be repaired for an architectural finish.

D. Performance, Testing, and Inspection:
1. General:
a. Comply with manufacturer's standards.
b. Comply with state and local building codes.
c. Jobsite inspections shall be done as herein specified and as listed in Drawings.
d. Testing shall be done as herein specified and as listed in Drawings.
2. Standards:

Item	Name of Test	Performance	Testing Std.
Unidentified materials	Test Lab	Refer to Structural Plans	Refer to Structural Plans
Examine seam welds of structural tubes and pipes	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
Material verification	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
High-strength bolts, nuts and washers	Test Lab	Refer to Structural Plans	Refer to Structural Plans
Bearing type connections	Special Inspection	Refer to Structural Plans	Refer to Structural Plans
Slip critical connections	Special Inspection	Refer to Structural Plans	Refer to Structural Plans

Non-destructive testing of partial joint penetration welds and complete joint penetration welds	Ultrasonic or magnetic particle (Test Lab)	Refer to Structural Plans	Refer to Structural Plans
Comply with Standards, Codes, Drawings, Specifications, and in accordance with agencies having jurisdiction.			
Refer to Drawings and as herein specified.			

3. Testing and inspections:
   a. General:
      1) Shall comply with 2022 CBC, including but not limited to Chapter 22.
   b. Testing laboratory:
      1) An inspection and testing laboratory will be selected by the Owner for testing and inspection as required by the Contract Documents.
      2) The selected laboratory shall conform to the requirements of ASTM E329.
      3) Documentary evidence of such conformance shall be submitted to the Owner.
   c. All materials, work, methods and equipment shall be subject to inspection at the mill, fabricating plant, and at the building site:
      1) Material or workmanship not complying fully with the Contract Documents will not be accepted.
      2) The General Contractor shall give the testing laboratory reasonable notice when ready for inspection and shall supply samples and test pieces and all facilities for inspection without extra charge.
      3) The Owner will assume the expense of making the tests and inspection except as otherwise specified in Section 01 40 00: Quality Requirements.
      4) All welding and high strength bolting shall be inspected. All high strength bolts shall be sampled and tested by an independent agency.
   d. The testing laboratory will check field fabrication for conformance to the Drawings and the referenced standards.
   e. Testing laboratory will inspect prime paint for thickness, coverage, and compliance with Specifications.
   f. Cost of testing and inspection:
      1) Costs of testing and inspection of structural steel, except as specified hereunder and in Section 01 45 23: Testing and Inspecting Services, will be paid for by the Owner
      2) All transportation costs and per diem living costs for inspection at fabricators' plant further than 75 miles from the jobsite will be back charged to the General Contractor.
      3) It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back charged to the General Contractor.
      4) All mill tests and costs of re-test of plain materials shall be at the expense of the General Contractor.
      5) Tests required due to General Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the General Contractor.
      6) Re-testing of items that failed original tests due to General Contractor’s poor and/or failed construction shall be at the expense of the Contractor.
   g. Structural steel testing and inspection:
      1) For shapes, plates, bars, pipe and tubing, manufacturer's certified mill test reports, and analysis for each heat will be acceptable in lieu of testing for steel identifiable in accordance with indicated ASTM designation. Mill test reports shall indicate the physical and chemical properties of all structural steel used. Correlate individual heat numbers with each specified structural section. Tests shall also be reviewed for supplemental requirements S91 and S5 per materials in this Section.

2) For unidentifiable steels listed above, one (1) tension and elongation test and one (1) bend or flattening test for each five (5) tons or fractional part thereof for each size will be performed by the testing laboratory:
   a) Comply with 2022 CBC.

h. Welding Inspection:
   1) All shop and field welded operations will be inspected by a qualified welding inspector employed by the testing laboratory. Such inspector will be a person trained and thoroughly experienced in inspection of welds on work requiring unquestioned reliability. The inspector's ability to distinguish between sound and unsound welding will be reliably established.
   2) The welding inspector will make a systematic record of all welds. This record shall include:
      a) Identification marks of welders.
      b) List of defective welds.
      c) Manner of correction of defects.
   3) The welding inspector will check the material, equipment, and procedure, as well as the welds. He will also check the ability of the welder. He will furnish the Architect with a report, duly verified by him, that the welding required to be inspected is proper and has been done in conformity with the Contract Documents, and that he has used all means to determine the quality of the welds.
   4) All full penetration groove welds will be subject to ultrasonic testing. All defective welds shall be repaired and retested with ultrasonic equipment at the General Contractor’s expense.
   5) Column flanges: An area extending six inches (6") above and below point where girder flanges are attached will be inspected. Column flange edges will be inspected visually and entire area ultrasonically for laminations, plate discontinuities, and non-metallic inclusions.
   6) Ultrasonic testing will test all partial penetration groove welds.
   7) When ultrasonic indications arising from the weld root are interpreted as either a weld defect or the backing strip itself, the Engineer and Owner will be notified. The Owner may require the removal of backing strip. The backing strip will be removed at the expense of the General Contractor, and if no root defect is visible the weld will be retested. If no defect is indicated on this retest, and no significant amount of base and weld metal have been removed, no further repair of welding is necessary. If a defect is indicated, it will be repaired and retested at General Contractor’s expense.
   8) The technician to evaluate the quality of the welds will calibrate the ultrasonic instrumentation.
   9) Other methods of inspection, for example, X-Ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the inspection laboratory, and with the approval of the Owner:
      a) Comply with 2022 CBC Chapter 17, including but not limited to Sections; 1704.3.1.
   10) Base metal thicker than 1-1/2 inch, when subjected to through thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such weld before and after joint completion.
   11) Tests of end-welded studs:
      a) Comply with 2022 CBC Section 1704.3.1 and AWS D1.1.
      b) Randomly test a minimum of ten (10) studs total with a minimum of three (3) from each heat. Physical properties shall conform to the minimums noted herein under Material Bolts.
   12) Ultrasonic testing:
      a) At the discretion of the Owner’s testing agency, the ultrasonic testing frequency may be reduced but may not be less than the following:
      b) Initially, all welds requiring ultrasonic testing will be tested at the rate of

100 percent in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than five percent (5%) of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25 percent. If the reject rate increases to five percent (5%) or more, 100 percent testing will be re-established until the rate is reduced to less than five percent (5%). The percentage of rejects will be calculated for each welder independently.

c) A sampling of at least 40 completed welds will be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over three feet (3') in length, each 12 linear inch increment of welds, one inch (1") or less in thickness, will be considered as one (1) weld. For evaluating the reject rate of continuous welds greater than one inch (1") thickness, each six (6) linear inches will be considered one (1) weld.

13) See structural plans for additional inspection requirements.

i. High strength bolting tests and inspection:

1) Furnish certified test reports for each lot of bolts in accordance with Section 9 of ASTM A325:
   a) Install bolts under the supervision of a qualified inspector in accordance with Section 9, Research Council using ASTM A325 bolts.
2) Testing laboratory will visually inspect all high strength bolts for tension:
   a) The bolts with the largest load indicator gaps (approximately ten percent [10%]) will be checked with a metal feeler gauge.
   b) Comply with 2022 CBC Sections.
3) Direct tension indicator washer testing:
   a) Perform testing of not less than three (3) indicator washers for each diameter and grade of fastener in a calibration device capable of indicating bolt tension.
   b) The test assembly shall include flat hardened washers, if required in the actual connection, arranged as those in the actual connections to be tensioned.
   c) The calibration test shall demonstrate that the indicator washers indicates a tension not less than five percent (5%) greater than that required by Table 4 of the AISC Specification for Structural Joints using ASTM A325 bolts.
   d) Manufacturer's installation procedure as required in Section 01 33 00: Submittal Procedures, shall be followed for installation of bolts in calibration device and in all connections.

1.5 WARRANTY

A. Refer to Section 01 77 00: Closeout Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 60 00: Product Requirements.

B. Store materials to permit easy access for inspection and identification:
   1. Keep steel members off the ground, using pallets, platforms, or other supports.
   2. Protect steel members and packaged materials from erosion and deterioration.

C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single Source Responsibility: Specified items shall be from one (1) manufacturer for each product type.

B. Acceptable manufacturers shall be as herein listed and in Drawings:
   1. Substitutions and deviations shall require Architect's approval and shall be given in letterform.
   2. Refer to Section 01 33 00: Submittal Procedures.
   3. Proposed alternate products must be equal in terms of chemical composition, color, finish, configuration, performance standards, etc.

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

D. Refer to Drawings, details, and other related Specification Sections, whether listed or not.

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

2.2 MATERIALS

A. Structural Steel:
   1. W shapes: ASTM A992 unless indicated otherwise on Drawings.
   2. Channels and other rolled shapes: ASTM A36 unless indicated otherwise on Drawings.
   3. Plates and bars: ASTM A36 unless indicated otherwise on Drawings.

B. AISC Group 4 and 5 shapes and plates greater than two inches (2") thick:
   1. ASTM A36/ASTM A572 Grade 50 with supplementary requirements S91 Fine Austenitic Grain Size and S5 Charpy V-Notch (CVN) Impact Test.
   2. For location of CVN test, see AISC figure C-A3.1c.
   3. CVN test shall be per ASTM A673, frequency P and shall meet a minimum average value of 20 ft-lbs absorbed energy at 70°F.
   4. Elements of the moment frames only.

C. Cold-Formed Steel Tubing: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53, Type E or S, Grade B.

E. Anchor Bolts:
   1. All anchor bolts cast in concrete shall be headed bolts with cut threads conforming to:
      a. ASTM A307 or ASTM A36 or ASTM F1554; Grade 36, or ASTM F1554; Grade 55 as indicated on Drawings.

F. Machine Bolts: ASTM A307.

G. High Strength Bolts, Nuts, and Washers:
   1. Bolt specifications:
      a. Bolts shall conform to the requirements of the most current adopted edition of the Specifications of the American Society for Testing and Materials for High-Strength Bolts for Structural Steel Joints, ASTM A325, Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength, as indicated on Drawings.
   2. Bolt geometry:
      a. Bolt dimensions shall conform to the current requirements of the American National

Standards Institute for Heavy Hex Structural Bolts.
b. The length of bolts shall be such that the end of the bolt will be flush with or outside the face of the nut when properly installed.
3. Nut specifications:
a. Nuts shall conform to the current chemical and mechanical requirements of the American Society for Testing and Materials Standard Specification for Carbon and Alloy Steel Nuts, ASTM A563.
4. Washers:
a. Flat circular washers and square or rectangular beveled washers shall conform to the current requirements of the American Society for Testing and Materials Standard Specification for Hardened Steel Washers, ASTM F436.
5. Direct tension indicator washers – ASTM F959: TurnaSure DTI (www.turnasure.com), Type 325.
6. Tension control fastener system: Lohr (www.lohrfasteners.com), LeJeune Bolt (www.lejeunebolt.com), Nucor Fastener (www.nucor.com), or Cordova Bolt, Inc. (www.cordovabolt.com).

H. Threaded Stud Bolts:
1. Comply with ASTM A108:
a. Tensile strength: 60,000 psi.
b. Elongation in two inches (2”): 20 percent.
c. Reduction of area: 50 percent.

I. Headed Stud-Type Shear Connectors:
1. Comply with ASTM A108 Grade 1015 or 1020 cold-finished carbon steel with dimensions complying with AISC Specifications:
a. Tensile strength: 60,000 psi.
b. Elongation in two inches (2”): 20 percent.
c. Reduction of area: 50 percent.

J. Provide hexagonal heads and nuts for all connections per ASTM A563, Appendix Table X1.1.

K. Electrodes for Welding:
1. Comply with AWS Code, E70 Series minimum.
2. Fabricator to select proper electrodes according to weld procedures as submitted.

L. Powder Driven Fasteners:
1. Tempered steel pins with special corrosive resistant plating or coating.
2. Pins shall have guide washers to accurately control penetration.
3. Fastening shall be accomplished by low-velocity piston-driven power activated tool.
4. Pins and tool shall be as manufactured by Hilti Fastening Systems (www.hilti.com).

M. Expansion Bolts: Hilti Fastening Systems (www.hilti.com) or approved equal.

N. Non-Shrink Grout: Refer to Section 03 30 00: Cast-In-Place Concrete.

O. Shop Primer:
1. Primer shall be compatible with primer and finish coats for exposed steel per Section 09 90 00: Painting and Coating.
2. Primers for concealed steel not to be painted per Section 09 90 00: Painting and Coating:
a. Type A material - Tnemec Company, Inc. Series 88HS Azeron H.S. Primer (www.tnemec.com):
1) Exposed conditions use primer in accordance with Section 09 90 00: Painting and Coating.

b. Type B material - Tnemec Company, Inc. Series 90-97 Tneme-Zinc:
   1) Exposed conditions use primer in accordance with Section 09 90 00: Painting and Coating.
c. All paints shall meet the California Air Resources Board Standards.

P. Primers and Finish Paint: Refer to Section 09 90 00: Painting and Coating.

Q. Hole Filler for Steel Columns and Beams: JB Weld (www.jbweld.com).

2.3 STEEL STRUCTURES PAINTING COUNCIL (SSPC)

A. Cleaning Standards:
1. SSPC-Vis 1 Pictorial Surface Preparation Standards for Painting Steel Structures.
2. SSPC-SP2 Hand Tool Cleaning.
3. SSPC-SP3 Power Tool Cleaning.
4. SSPC-SP6 Commercial Blast Cleaning.
5. SSPC-PA2 Measurement of Dry Paint Thickness with Magnetic Gauges.

B. Paint:
1. As herein indicated and in accordance with Section 09 90 00: Painting and Coating.
2. Coordination of Work:
   a. Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates.
   b. Shop priming may be omitted if approved by Owner and covered under Section 09 90 00: Painting and Coating.
3. Requirements of regulatory agencies: Comply with applicable rules and regulations of governing agencies for air quality control.

C. Shop Primer:
1. All paints shall meet the California Air Resources Board Standards:
2. Concealed steel: As herein listed.
3. Exposed steel:
   a. Comply with Section 09 90 00: Painting and Coating.
   b. Shop priming may be omitted if approved by Owner and covered under Section 09 90 00: Painting and Coating.

PART 3 EXECUTION

3.1 JOB CONDITIONS

A. All steel shall be dry and clean per paint manufacturer’s recommendations as herein specified and listed in Section 09 90 00: Painting and Coating prior to field shop and/or field painting.

3.2 COORDINATION

A. Refer to Section 01 31 00: Project Management and Coordination.

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

3.3 SEQUENCING/SCHEDULING

A. Cooperate and coordinate this work with other trades for anchor bolts, and other required inserts, templates, painting, etc.:

1. Align this work prior to installation of other materials.

3.4 INSPECTION/EXAMINATION

A. Verification of Conditions:
   1. Examine areas and conditions under which work is to be performed.
   2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.
   3. Do not proceed until unsatisfactory conditions are corrected.
   4. Proceeding with the work signifies that Contractor accepts the substrate, surfaces, and conditions, and any problems related to the substrate shall be repaired to the satisfaction of the Owner's representative without any additional cost to the Owner.

3.5 PREPARATION

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

B. Protection:
   1. Protect finish surfaces at all times from surfaces and material adjacent to them.
   2. Finish work defaced with other materials on surface shall be replaced.
   3. Protect work under this Section from damage by other trades.

3.6 FABRICATION

A. Exterior Steel: All exterior exposed steel shall be welded watertight to all steel including, but not limited to, steel columns, beams, outriggers, eave beams, metal decking, etc.

B. Shop Fabrication and Assembly:
   1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated:
      a. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
      b. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

C. Connections: Weld or bolt shop connections, as indicted. Bolt field connections, except where welded connections or other connections are indicated.

D. High Strength Bolts: Install in accordance with requirements for A325 and A490 slip critical and snug tight conditions as indicated on Drawings. Tighten nuts by the turn-of-the nut method or by use of a direct tension indicator. Install hardened washers in conformance with AISC Specifications. Mark bolts that have been completely tightened with an identifying symbol. Final tightening of high strength bolts in webs of beam to column moment connection shall be performed after completion of flange welding.

E. Install high strength bolts with snug tight type connections with threads excluded from shear plane except as otherwise noted. Holes are 1/16 inch larger unless noted otherwise in Drawings. Tighten high strength bolts to the bolt tension required by the referenced AISC standard using direct tension indicators.

F. Unless noted otherwise, make holes 1/16 inch larger than the nominal bolt diameter unless noted otherwise in Drawings.

G. Welding, Shop, and Field: Weld by Shielded Metal Arc Welding (SMAW) method, submerged arc method, Flux Core Arc Welding (FCAW) method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, shall be certified in accordance with AWS "Standard Qualification Procedure" for the Work to be performed. See paragraph "welding" herein, for detailed requirements. If sizes of fillet welds are not shown on Drawings, use AWS minimum weld size but not less than 3/16-inch fillet welds.

H. Bolt Holes for Other Work:
   1. Provide holes required for securing other work to structural steel framing:
      a. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
      b. Cut, drill, or punch holes perpendicular to metal surfaces and remove all burrs. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

I. High Strength Bolts:
   1. Installation and tightening:
      a. Handling and storage of fasteners - Fasteners shall be protected from dirt and moisture at the jobsite. Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protected storage. Fasteners not used shall be returned to protected storage at the end of the shift. Fasteners shall not be cleaned of lubricant that is present in as-delivered condition.
      b. Tension calibrator - A tension measuring device shall be required at all jobsites where bolts in slip-critical joints are being installed and tightened. The tension measuring device shall be used to confirm (1) the suitability to satisfy the requirements of AISC for the complete fastener assembly, including lubrication if required to be used in the work, (2) calibration of wrenches, if applicable, and (3) the understanding and proper use by the bolting crew of the method to be used. The frequency of confirmation testing, the number of tests to be performed, and the test procedure shall be as specified below, as applicable. The accuracy of the tension measuring device shall be confirmed through calibration by an approved testing agency at least annually.
      c. Joint assembly and tightening of shear/bearing connections - Bolts in connections not within the slip-critical category shall be installed in properly aligned holes, but need only be tightened to the snug tight condition. The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. If a slotted hole occurs in an outer ply, a flat hardened washer or common plate washer shall be installed over the slot.
      d. Joint assembly and tightening of connections requiring full pre-tensioning - Slip-critical connections shall be installed in properly aligned holes and tightened by one of the following methods:
         1) Turn-of-nut tightening: When turn-of-nut tightening is used, hardened washers are not required except as specified in the AISC. A representative sample of not less than three (3) bolts and nuts of each diameter, length, and grade to be used in the Work shall be checked at the start of work in a device capable of indicating bolt tension. The test shall demonstrate that the method of estimating the snug-tight condition and controlling turns from snug tight to be used by the bolting crews develops a tension not less than five percent (5%) greater than the tension required for slip-critical connections.
         2) Installation of alternate design bolts: A representative sample of not less than three (3) bolts of each diameter, length, and grade shall be checked at the jobsite in a device capable of indicating bolt tension. The test assembly shall include flat hardened washers, if required in the actual connection, arranged as in the actual connections to be tensioned. The calibration test shall demonstrate that each bolt develops a tension not less than five percent

(5%) greater than the tension required by AISC. Manufacturer's installation procedure shall be followed for installation of bolts in the calibration device and in all connections. When alternate design features of the fasteners involve an irreversible mechanism such as yield or twist-off of an element, bolts shall be installed in all holes of the connection and initially brought to a snug tight condition. All fasteners shall then be tightened, progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize relaxation of previously tightened fasteners prior to final twist-off or yielding of the control or indicator element of the individual fasteners. In some cases, proper tensioning of the bolts may require more than a single cycle of systematic tightening.

3) Mark bolts that have been completely tightened with an identifying symbol. Final tightening of high strength bolts in webs of beam to column moment connections shall be performed after completion of flange welding.

3.7 WELDING

A. General:
   1. Quality of materials and design and fabrication of all welded connections shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Building," "AWS Code for Welding in Building Construction," and requirements of this Section:
      a. Location and type of all welds shall be as shown. Make no other welded splices, except those shown on Drawings, without prior approval of the Architect and Engineer.

B. Exterior Steel: All exterior steel metal decking shall be welded continuous and watertight to steel connections.

C. Automatic Welding: Use electrode wire and flux for automatic and semi-automatic welding acceptable to Architect. All methods, sequences, qualification and procedures, including preheating, and post heating if necessary, shall be detailed in writing and submitted to the Architect for review.

D. Qualification of Welders:
   1. Structural steel welding: Manual and automatic welds for structural steel construction shall be made only by operators who have been previous qualified by tests to perform type of work required.
   2. Welders shall be checked by welding inspector. Those not doing satisfactory work may be removed and may be required to pass qualification tests again. All qualification testing shall be at the General Contractor’s expense.
   3. Only welders whose weld procedures and pre-qualification by testing that have passed shall be considered qualified for such welds.

E. Control cooling process after weld is completed by either step down post heat or thermal blankets as determined by procedures and pre-qualification.

F. Flame cut surfaces shall be ground to remove contaminated steel layer to provide welds proper fusion without impurities.

G. Preparation of Surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint, and any other foreign material.

H. Welding Equipment: Welding equipment to be used in each case shall be acceptable to welding inspector. Use equipment with suitable devices to regulate speed and manually

adjust operating amperage and voltage. The amperage capacity shall be sufficient to overcome line drop and to give adequate welding heat.

I. Remove runoffs tabs and grind surfaces smooth where the tabs would interfere with fireproofing and architectural finishes.

J. Automatic End-Welded Studs: Automatically end-weld in accordance with the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plates. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch, and 3/16 inch for 3/4-inch diameter. Stud sizes indicated on Drawings represent the finish stud height.

K. Welding requirements shall be as follows:
1. The General Contractor shall be required to furnish a fabrication/erection inspector and the Owner to employ a verification inspector. Visual inspection means that the inspector visually inspects the welding for adherence to the approved weld procedure specification starting with fit-up and proceeding through the welding process. Reliance only upon use of Non-Destructive Examination (NDE) at the end of the welding should be avoided. Use visual inspection in conjunction with NDE for a sound weld.
2. A Welding Procedure Specifications (WPS) shall be submitted to the Owner and the enforcement agency for acceptance prior to the start of work. The WPS shall be used in providing the required special inspection. The WPS shall contain the actual values to be used for the welding parameters and variable so that instruction is provided to welders; as a minimum the WPS shall list the position, electrode type, and size, travel speed, electrode stick-out, voltage and amperage with acceptable limits, bead size, weld sequence, stress relieving, and other pertinent data. A copy of the filler metal manufacturer’s technical data sheet shall be submitted with each WPS. Welding consumables must be used within the positions, thickness, temperatures, and other parameters provided by the manufacturer. For WPSs requiring qualification, Procedure Qualification Records (PQRs) shall also be submitted for acceptance. Production welding heat input should be limited based on the PQR.
3. WPSs for FCAW shall be qualified by testing. The tests shall include CVN tests to the weld metal.
4. SMAW and FCAW, both self-shielded (FCAW-SS) and gas shielded (FCAW-G), are suitable processes.
5. The maximum diameter for the flat and horizontal position shall be limited to 7/64 inch.
6. Maximum width and thickness of weld layers shall be:
   a. The thickness of a root layer shall not exceed 1/4 inch.
   b. The maximum width of a layer in any position shall not exceed 5/8 inch.
   c. The width of a weave bead shall not exceed three times the electrode (wire) diameter, d, when d > 3/32 inch, or five times the electrode diameter when d < 5/64 inch.
7. The filler metal used shall have a notch toughness not less than of 20 ft-lbs as measured by a standard CVN test, ASTM E23. The CVN test temperature shall be at least 0°F. The minimum required energy absorption is 20 ft-lbs average. One (1) specimen may be less than the minimum average, but not less than 15 ft-lbs. The test shall be conducted in accordance with the applicable filler metal specification and may be performed by the manufacturer.
8. For highly restrained joints, or where shrinkage is likely to cause problems, the General Contractor shall submit a weld shrinkage and distortion control plan to the Engineer/Owner for review to determine compliance with design intent.
9. All welds shall be started and ended with a full cross section weld for a minimum length of one inch (1”) on weld tabs (“run off” tabs) except at access holes in beam/girder webs. All weld tabs shall be removed, the affected area ground smooth and magnetic particle tested for defects. Minimum weld tab length shall be the greater of one inch

(1”) or 1.5 times the beam flange thickness but need not exceed four inches (4”).

10. If backing bars are used under the bottom beam flange to column flange CJP groove weld, the backing bar shall be removed, the removal area ground to sound, bright metal and the area magnetic particle tested for defects. A reinforcing fillet weld, at least 1/4 of the bottom flange thickness but not greater than 3/8 inch, shall be placed in this location.
11. If a backing bar is used under the top beam flange to column CJP groove weld and is not removed, the backing bar shall be attached to the column and beam flanges by either a fillet weld along the complete bar length on the underside of the bar, or by a partial penetration weld from the underside of the bar, for the full length of the bar. Other methods of welding the bar to the column and beam may be used subject to the Engineer’s and Owner’s approval.
12. Weld dams are not allowed. Weld dams are weld tabs not aligned in such a manner to provide an extension of the joint preparation. Weld dams are typically perpendicular to proper weld tabs.
13. All tack welds shall be of the same quality as the final welds. This includes requirements for preheat. All tack welds not incorporated into the final welds shall be removed.
14. Preheat, if required by the following requirement, shall be used for all welds including tack welds. Preheat and interpass temperatures shall be determined using the hydrogen controlled method. The maximum interpass temperature shall not exceed 550 degrees. Welds for sections in ASTM A6 Shape Size Groups 4 and 5 and plates with a thickness greater than 2-1/2 inches shall have a minimum preheat of 350°F. To ensure that the work piece is properly heated, the temperature of the part shall be measured at a distance from the axis of the weld equal to twice the thickness of the thickest part being welded, but in no case less than three inches (3”) in all directions, including the through thickness dimension of the part being welded, for the full length of the weld joint. Preheat shall be verified by the inspector before welding commences. The cooling rate of the weldment shall be controlled with thermal insulation or other appropriate methods to a maximum of 250°F/hr.
15. An acceptable method for installing flat reinforcing plates aligned parallel to the top or bottom flange is as follows: The reinforcing plate for the bottom flange shall be welded to the column in the fabricating shop using a complete penetration, two-sided, double joint. This weld shall be inspected by ultrasonic examination. The balance of the welding is to be done in the field. The reinforcing plate for the top flange shall be shipped loose. After the top flange has been welded to the column, ultrasonically examined, and accepted, the top flange weld surface shall be prepared, and the reinforcing plate fitted for welding to the column. The reinforcing plate shall be restrained from rotation during welding to the column. After completion of the reinforcing plate to the column weld, the reinforcing plate shall be welded to the top flange.
16. Welders that will make welds with restricted access, such as, but not limited to, the beam bottom flange to column welds through a cope hole or access hole in the beam web, or where access to the bottom of a groove weld is restricted by the presence of a column flange, shall be qualified by the General Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.
17. Mill scale shall be removed from the column in the area where the beam flange will be welded to the column.
18. General Contractor shall submit to the structural Engineer, for acceptance, a quality control or inspection plan that addresses all inspection issues, including in-process and final inspection.
19. The qualification of the General Contractor’s Inspectors and NDE personnel shall be submitted to the Owner for acceptance.
20. In cases of differences of opinion between the Owner’s inspector and the General Contractor’s’ inspector regarding conformance of a weld with the Specifications, the

issue shall be brought to the Owner's structural Engineer and the enforcement agency as part of the resolution process.

21. All groove welds in the girder-to-column connection shall be ultrasonically examined for the full length. Backing bar removal areas and fillet welds on continuity plates shall be examined for the full length by the magnetic particle testing (MPT) method.
22. Shear connection plates shall be sized so that they do not interfere with welders' access to make flange welds or to perform work that is required to install or remove backing or to place reinforcing fillet welds.

L. Cleaning, Priming, and Finish Painting:
1. All exterior steel and other locations indicated to be exposed or painted shall be sandblasted.
2. All interior steel shall be cleaned in accordance with SSPC guidelines:
   a. Exposed steel shall be sandblasted for architectural appearance.

3.8 INSTALLATION/ERECTION

A. Exterior Steel: All construction shall be modified as approved by structural Engineer and Owner for a watertight finish product including, but not limited to, metal filler putty and welding for a watertight assembly typical.

B. Structural Steel Erection: Comply with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Building", current adopted edition at time of permit issuance.

C. Erection Sequence: Erect steel in accordance with special erection sequences where special erection sequences are indicated on the Contract Documents.

D. Before and during erection, keep all structural steel clean. Ship, handle, and store steel in manner to avoid injury to members. Steel members showing evidence to rough handling or injury will be rejected.

E. Mark each member with erection identification corresponding to mark shown on erection drawings. When marking steel in exposed conditions, the markings shall be made with easily removable chalk or similar pencil to avoid bleed through after painting. Carefully plan erection of structural steel so that no cutting and removal of material will be necessary. Do not torch burn in the field, unless specifically permitted by Engineer.

F. Provide sufficient bracing, shoring, and guys to effect safe and satisfactory erection. Provide bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made and until lateral force resisting elements are deemed by Architect capable of bracing structure. Temporary bracing shall be adequate to resist lateral forces from wind or seismic prior to the completion of the lateral resisting system.

G. Set bearing and base plates with extreme care. Bring level to line and grade with leveling plates or by leveling nuts and bolts. Grout solid under plates with a flowable non-shrink grout per Section 03 30 00: Cast-In-Place Concrete prior to applying vertical loads.

H. Field Assembly:
1. Set structural framing accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment:
   a. Level and plumb individual members of the structure within specified AISC tolerances except as noted herein.

I. All welds shall be full and clean and conform to AISC and AWS specifications.

J. Erection Tolerances:
1. Individual pieces shall be erected so that the deviation from plumb, level, and alignment shall not exceed 1 to 500 except that:
   a. The maximum overall height displacement of the centerline of columns at elevator shafts, from the established column line, shall not be more than one inch (1") at any point, measured from base of shaft to top of shaft.
   b. In order to provide a true, flat plane for the exterior elevations, install all steel framing at the exterior walls of the building so that the center lines of such framing do not vary by more than one inch (1”) for the length of the building.
   c. All columns and beams shall adhere to Section M2.7 of the referenced "Specification for Structural Steel for Buildings," which states that completed members shall be free of twists, bends, and open joints. Take special care that column base plates are parallel and perpendicular to faces of columns and that bolt holes are accurately placed.

K. Temporary Flooring:
1. Provide planking and scaffolding necessary in connection with erection of structural steel, support of erection machinery, and construction materials. Temporary floors and use of steel shall be as required by applicable regulatory requirements.
2. If steel decking is used as a working platform, it shall be temporarily tack-welded to supports to extent necessary for such use in accordance with applicable regulatory requirements. The concentrated loading from welding machines and other heavy machinery required for steel erection shall be distributed by planking or other approved means. Metal decking that becomes damaged as the result of being used as a working platform shall be replaced at no additional cost to the Owner.

3.9 PAINTING AND REPAIR/TREATMENT

A. General:
1. Prior to paint applications, clean all loose rust, mill scale, oil, dirt, and all other materials from all steel to be left exposed.
2. Clean contact surfaces of high strength bolts of all burrs and material that might prevent solid seating of the parts.
3. After erection, field touch up all welded areas, high strength bolts, and damaged areas. For all steel to remain exposed, remove all blemishes, paint drips, and touch up prime coat.
4. After erection of steel to be exposed and painted, fill in all dimples and like defects from steel rolling and other sources prior to finishing.
5. Shop prime all steel except the following:
   a. Steel encased in concrete.
   b. Contact surfaces for high strength bolts.
   c. Areas within four inches (4”) of field welds.
   d. Steel to be fireproofed.
   e. Surfaces to be galvanized.
   f. Steel that will be primed and finish painted under Section 09 90 00: Painting and Coating:
      1) Coordinate with Section for type and schedule of painting.

B. Exposed Interior Steelwork - When approved by Architect, use the following cleaning and priming/finish painting schedule/method:
1. Use primer and finish paint as required under Section 09 90 00: Painting and Coating.
2. Surface preparation:
   a. Sequence:
      1) First, use hand tool (SP-2) as required to assist with preparation.

2) Second, use power tool (SP-3) as required to assist with preparation.
3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
4) Fourth, use SSPC-SP6 Commercial Blast Cleaning as final preparation method.

3. Application - Follow coating manufacturer's printed directions:
   a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
   b. Finish painting in field in accordance with Section 09 90 00: Painting and Coating:
      1) Apply finish paint to area's concealed when installed in the field.
4. Material:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
5. Number of Coats:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
6. Dry Film Thickness:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
7. Volume Solids:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.

C. Concealed Interior Steelwork - When approved by Architect, use the following cleaning and primer painting schedule/method:
1. For concealed conditions not to be finish painted, use primer paint as required under Section 09 90 00: Painting and Coating.
2. Surface Preparation:
   a. Sequence:
      1) First, use hand tool (SP-2) as required to assist with preparation.
      2) Second, use power tool (SP-3) as required to assist with preparation.
      3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
3. Application - Follow coating manufacturer's printed directions:
   a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
4. Material:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
5. Number of Coats:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
6. Dry Film Thickness:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
7. Volume Solids:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.

D. Exposed Exterior Steelwork - When approved by Architect, use the following cleaning and priming/finish painting schedule/method:
1. Use primer and finish paint as required under Section 09 90 00: Painting and Coating.
2. Surface Preparation:
   a. Sequence:
      1) First, use hand tool (SP-2) as required to assist with preparation.
      2) Second, use power tool (SP-3) as required to assist with preparation.
      3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
      4) Fourth, use SSPC-SP6 Commercial Blast Cleaning as final preparation method.
   b. Fill holes for watertight assembly:
      1) First, weld all holes as approved by structural Engineer
      2) Second, holes not approved to be welded shall be filled with INDUSTRO WELD by JB Industries.
      3) Install in accordance with manufacturers printed instructions.
3. Application - Follow coating manufacturer's printed directions:
   a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
   b. Finish painting in field in accordance with Section 09 90 00: Painting and Coating:
      1) Apply finish paint to area's concealed when installed in the field.

4. Material:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
5. Number of Coats:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
6. Dry Film Thickness:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
7. Volume Solids:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.

E. Concealed Exterior Steelwork - When approved by Architect, use the following cleaning and primer painting schedule/method:
1. For concealed conditions not to be finish painted, use primer paint as required under Specification Section 09 90 00: Painting and Coating or as approved alternate by Architect.
2. Surface preparation:
   a. Sequence:
      1) First, use hand tool (SP-2) as required to assist with preparation.
      2) Second, use power tool (SP-3) as required to assist with preparation.
      3) Third, use chemical cleaning (SP-8) as required to assist with preparation.
3. Application - Follow coating manufacturer's printed directions:
   a. Apply two (2) shop prime coats to areas that will be inaccessible after erection.
4. Material:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
5. Number of Coats:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
6. Dry Film Thickness:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.
7. Volume Solids:
   a. Exposed: Refer to Section 09 90 00: Painting and Coating.

3.10 HOISTING AND BRACING

A. Provide all hoisting and erecting equipment and power.

B. Provide and maintain any and all safety railings, toe boards, etc. required for the erection of steel framing and metal decking.

C. Brace the erected frame in a manner that will assure safety and proper alignment to receive the metal decking and until the concrete slabs have been poured and have set.

D. Erect building frame true and level. Erect columns in a manner to allow for movement due to welding shrinkage and thermal expansion and contraction of framing. Check plumbness after erection of each level. Maintain structural stability of frame during erection. Provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

3.11 PROTECTION AND CLEAN UP

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

B. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades:
1. Clean adjacent surfaces free of rust and oil, flux with mechanical action or solvent as necessary, avoiding damage to other materials.

C. Perform work in accordance with manufacturer's recommendations, as herein specified, and in accordance with Drawings.

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

E. After completion of work in this Section, remove all erection equipment and implements of service, and debris:
   1. Leave entire area in a neat, clean, acceptable condition.

F. Provide guarantee/warranties and bonds as required in this Section.

G. Provide record drawings in accordance with Section 01 77 00: Closeout Procedures and Section 01 78 39: Project Record Documents.

H. Closeout onsite inspection will be at the discretion of the Architect after he receives the General Contractor's notice of Certificate of Substantial Completion.

END OF SECTION 05 12 00

SECTION 05 50 00 METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Steel framing and supports.
2. Shelf angles.
3. Miscellaneous steel trim including steel angle corner guards, and steel edgings.
4. Metal downspout boots.
5. Roof anchor points.
6. Roof hatches.
7. Bicycle racks.
8. Metal finishes.
9. Accessories necessary for a coordinated and complete installation.

B. Related Sections:
1. Section 03 30 00: Cast in Place Concrete.
2. Section 09 21 16: Gypsum Board Assemblies.
3. Section 09 24 00: Cement Plastering.
4. Section 09 90 00: Painting and Coating.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders and countertop supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Roof Anchor Points. Provide anchor points suitable for support of 5,000 pounds breaking point (see structural drawings).

C. Structural Performance of Ladders: Provide ladders and landings capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

D. Structural Performance:
1. Countertops and vanities:
a. Provide countertop and vanity framing capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
1) All deadloads.
2) 250-pound live load placed on the countertop and vanity.
3) Deflection at midspan: L/1000 times span or 1/8 inch, whichever is less.

E. Thermal Movements:
1. Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and

other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
a. Temperature change (range): 70 degrees F, ambient; 110 degrees F, material surfaces.

1.4 SUBMITTALS

A. Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories.

B. Shop Drawings:
1. Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items:
   a. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding Certificates.

E. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building Code: Comply with applicable provisions of the CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
2. Welding:
   a. Qualify procedures and personnel according to the following:
      1) AWS D1.1/D1.1M Structural Welding Code – Steel.
      2) AWS D1.2/D1.2M Structural Welding Code - Aluminum.
      3) AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
      4) AWS D1.6/D1.6M Structural Welding Code - Stainless Steel.
      5) Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Fabricator/Installer Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project for a minimum of five (5) years, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle to prevent any type of damage to the fabricated work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A276, Type 304.

E. Rolled Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Rolled Stainless Steel Floor Plate: ASTM A793.

G. Abrasive Surface Floor Plate:
   1. Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel:
      a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) IKG Industries, a division of Harsco Corporation.
         2) SlipNOT Metal Safety Flooring; W.S. Molnar Company.

H. Steel Tubing: ASTM A500/A500M, cold formed steel tubing.

I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

J. Zinc Coated Steel Wire Rope - ASTM A741:
   1. Wire rope fittings: Hot dip galvanized steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

K. Slotted Channel Framing:
   1. Cold formed metal box channels (struts) complying with MFMA-4:
      a. Size of channels: 1-5/8 inch by 1-5/8 inch (41 mm by 41 mm).
      b. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B. with G90 (Z275) coating; 0.108-inch (2.8 mm) nominal thickness.
      c. Cold formed metal channels: Flange edges returned toward web and with 9/16-inch (14.3 mm) wide slotted holes in webs at two inches (51 mm) o.c.
      d. Width of channels: 1-5/8 inch (41 mm).
      e. Depth of channels: Indicated on Drawings.
      f. Metal and thickness: Galvanized steel complying with ASTM A653/A653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8mm) nominal thickness.
      g. Finish: Hot dip galvanized after fabrication.

L. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

M. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

N. Aluminum Alloy Rolled Tread Plate: ASTM B632/B 632M, Alloy 6061-T6.

O. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

P. Fasteners:

1. Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required:
   a. Provide stainless steel fasteners for fastening stainless steel.
   b. Provide bronze fasteners for fastening bronze.
   c. Steel bolts and nuts: Regular hexagon head bolts, ASTM A307, Grade A with hex nuts, ASTM A563 and, where indicated, flat washers.
   d. Steel bolts and nuts: Regular hexagon head bolts, ASTM A325, Type 3 with hex nuts, ASTM A563, Grade C3 and, where indicated, flat washers.
   e. Stainless steel bolts and nuts: Regular hexagon head annealed stainless steel bolts, ASTM F593 with hex nuts, ASTM F594 and, where indicated, flat washers; alloy.
   f. Anchor bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 and, where indicated, flat washers.
   g. Hot dip galvanize or provide mechanically deposited zinc coating where item being fastened is indicated to be galvanized.
   h. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
   i. Post installed anchors - per Drawings:
      1) Material for interior locations: Carbon steel components zinc plated to comply with ASTM B633 or ASTM F1941 Class Fe/Zn 5, unless otherwise indicated.
      2) Material for exterior locations and where stainless steel is indicated: ASTM F593 and nuts, ASTM F594.

Q. Miscellaneous Materials:
1. Shop primer for ferrous metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Provide 10-99 (red) or 10-09 (gray) by Tnemec Company.
2. Universal shop primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
3. Water based primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel and compatible with topcoat.
4. Shop primer for galvanized steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
5. Galvanizing repair paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Provide Tneme-Zinc 90-97 by Tnemec Company.
6. Bituminous paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187.
7. Non-shrink, nonmetallic grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
8. Concrete materials and properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8 inch with at least 95 percent passing a 3/8-inch sieve and not more than 10 percent passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28-day compressive strength of 3,000 psi (20 MPa).

2.2 FABRICATION

A. Shop Assembly:

1. Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation:
   a. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
   b. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   c. Form exposed work with accurate angles and surfaces and straight edges.
   d. Weld corners and seams continuously to comply 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) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
   e. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
   f. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
   g. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
   h. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   i. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with a minimum six-inch (150 mm) embedment and two-inch (50 mm) hook, not less than eight inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

B. Miscellaneous Framing and Supports:
   1. Provide steel framing and supports necessary to complete the work and that are not a part of the structural framework, including, but not limited to, framing and supports for overhead lobby door frames, sliding doors, countertop and vanities, ceiling hung toilet compartments, tube framing for partial height walls, and mechanical and electrical equipment:
      a. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items:
         1) Fabricate units from slotted channel framing where indicated.
         2) Furnish inserts for units installed after concrete is placed.

C. Shelf Angles:
   1. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19 mm) bolts, spaced not more than six inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated:
      a. Provide mitered and welded units at corners.
      b. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately two inches (50 mm) larger than expansion or control joint.

c. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
d. Galvanize and prime shelf angles located in exterior walls.
e. Prime shelf angles located in exterior walls with zinc rich primer.
f. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.3 MISCELLANEOUS STEEL TRIM

A. Miscellaneous Steel Trim:
1. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible:
a. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work:
1) Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than six inches (150 mm) from each end, six inches (150 mm) from corners, and 24 inches (600 mm) o.c.
b. Cast in pit angles and edge angles: Provide edge angles, and pit angles, fabricated from angles of size as shown, or required, with welded on stud anchors spaced 24 inches (600 mm) on center. Provide pit and edge angles in as long lengths as possible. Miter and weld corners and provide splice plates for alignment between sections.
c. Galvanize miscellaneous steel trim.

2.4 METAL DOWNSPOUT BOOTS

A. Downspout Boot:
1. Provide downspout boots made from cast aluminum in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts:
a. Outlet: Vertical, to discharge into pipe.
b. Prime cast iron downspout boots with zinc rich primer.

2.5 BICYCLE RACKS

A. Bicycle Rack:
1. Fabricate from Schedule 40 steel pipe, fully welded together, to lengths indicated. AAA Ribbon Bike Rack Co. (basis of design):
a. Fabricate with NPS 3 (DN 80) top rails and end posts, NPS 1-1/2 (DN 40) bottom rails and intermediate posts not more than 72 inches (1800 mm) o.c., and NPS 3/4 (DN 20) vertical separators at approximately eight inches (200 mm) o.c.
b. Make top rails 36 inches (900 mm) above pavement/floor and bottom rails four inches (100 mm) above pavement/floor.
c. Fabricate end posts and intermediate posts with 1/4-inch (6.4-mm) thick steel baseplates for bolting to concrete slab. Drill end post baseplates at all four corners and intermediate-post baseplates at two opposite sides for 1/2-inch (12.7-mm) anchor bolts.
d. Galvanize bicycle racks after fabrication.

2.6 ROOF HATCH AND RAILING

A. Roof Hatch:
1. Model Numbers #E-2424-RAH-CM and E-3030-RAH-CM series as manufactured by ELMDOOR-STONEMAN Access Doors, City of Industries, CA 800-591-9181 or www.elmdoorstoneman.com. Or approved equal:

a. 14-guage (A60) galvannealed steel with radius corners and shall be fully welded and watertight construction.
b. Latching: Both inside and outside padlock hatch and handles.
c. Include automatic hold-open arm with vinyl grip and compression springs incased in telescoping tubes for smooth operations.

B. Roof Hatch Safety Rails:
1. Manufactured by Safe-Pro. 1355 N Walton Walker Road, Dallas Texas 75211. (877) 723-3570. Provide complete system to match roof hatch:
a. Four-sided railing with safety hand grip rails. 1-1/2 inch OD .083 wall cold-rolled electric welded (CREW) steel.
b. Powder coated safety yellow.
c. Gravity self-closing with spring assist, non-collapsible full wrap-around 1-1/2-inch tubing. Heavy duty hinges, 5/8-inch hinge pin. Include back-cross rails and tube terminal end plugs.
d. Smooth saddle joint bolt-on with 3/8 inch by three-inch (3”) bolts and 3/8-inch tubing connector nuts. ASTM 316 SS.

2.7 ROOF ANCHOR POINTS

A. Roof Anchor Points:
1. Guardian Fall Protection Model CB-12 Anchor Point. Include anchor plate with multiple connection points:
a. Minimum breaking strength: 5,000 pounds.
b. Provide roof flashing cones. See Section 07 72 00: Roof Accessories.

2.8 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).

D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).

E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.9 FINISHES

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

A. Galvanizing:
1. Hot dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products:
a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

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

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming:
   1. Prepare surfaces to comply with requirements indicated below:
      a. Exterior items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
      b. Items indicated to receive zinc-rich primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
      c. Other items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming:
   1. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting:
      a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. Stainless Steel Finishes:
   1. Remove tool and die marks and stretch lines, or blend into finish:
      a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
      b. Bright, directional polish: No. 4 finish.
      c. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.11 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish - AAMA 611:
   1. Class I, Clear anodic finish:
      a. AA-M12C22A41 (mechanical finish: non-specular as fabricated.
      b. Chemical finish: Etched, medium matte.
      c. Anodic coating: Architectural Class I, clear coating 0.018 mm or thicker, complying with AAMA 607.1.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Field Measurements:
   1. Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication:
      a. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
      b. Provide allowance for trimming and fitting at site.

3.2 COORDINATION

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

B. Coordinate installation of metal fabrications that are anchored to or that receive other work.

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

3.3 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack, and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding:
   1. Comply with the following requirements:
      a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      b. Obtain fusion without undercut or overlap.
      c. Remove welding flux immediately.
      d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection:
   1. Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
      a. Cast aluminum: Heavy coat of bituminous paint.
      b. Extruded aluminum: Two (2) coats of clear lacquer.

3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturer’s written instructions and requirements indicated on shop drawings.

B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.5 INSTALLING METAL BOLLARDS

A. Fill metal capped bollards solidly with concrete and allow concrete to cure seven (7) days before installing:
   1. Do not fill removable bollards with concrete.

3.6 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07 92 00: Joint Sealants to provide a watertight installation.

3.7 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch (6mm).

C. Maximum Out of Position: 1/4 inch (6mm).

3.8 ADJUSTING AND CLEANING

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces:
      a. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00: Painting and Coating.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes rough carpentry, light hardware, and miscellaneous items of work not included in another Section. This Section also includes:
   1. Structural wood supports, grounds, backing, and blocking required for wood framed structures including but not limited to flooring, wall, roof and ceiling construction.
   2. Backing/blocking for millwork and casework items that are an integral part of wall, floor, and/or ceiling construction.
   3. Backing/Blocking for Mechanical-Plumbing-Electrical work and equipment.
   4. Plywood sheathing.

B. Related Sections:
   1. Section 03 10 00: Concrete Forming and Accessories.
   2. Section 03 30 00: Cast-In-Place Concrete.
   3. Section 07 21 00: Thermal Insulation.
   4. Section 07 41 13.02: Prefinished Metal Roofing.
   5. Section 07 92 00: Joint Sealants.
   6. Section 09 21 16: Gypsum Board Assemblies.
   7. Section 09 24 00: Cement Plaster.
   8. Section 10 28 13: Toilet Accessories.

C. Reference Standards:
   1. The following references, codes, and standards are hereby made a part of this Section and carpentry work shall conform to applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained in the Drawings or these Specifications shall be construed as permitting work that is contrary to code requirements:
      a. Standard Grading and Dressing Rule #16, of the West Coast Lumber Inspection Bureau.
      b. Grading Rules for Western Lumber of the Western Wood Products Association.
      c. Standard Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service.
      d. American Wood Preservers Association (AWPA) Standard C 2-77 Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
      e. American Wood Preservers Bureau (AWPB) Quality Control Standards.

1.3 QUALITY ASSURANCE

A. Lumber and plywood shall be grade or quality marked by WWPA, WCLIB, APA, AWPB, or by other grading and inspection agencies acceptable to the Architect. Grade marks shall include the designation "S-DRY"(or "MC-15" as applies) where applicable. Grade and quality marks shall not be apparent on surfaces exposed in the finished work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store kiln dried materials in enclosed areas, protected from moisture and separated from contact with concrete or soil.

PART 2 PRODUCTS

2.1 MATERIALS

A. Temporary Construction: Clean lumber at Contractor's option, rough or smooth, as usage requires.

B. Lumber Not Otherwise Specified or Noted:
1. Douglas fir or larch, graded and grade-marked, according to Reference Standard 1.02 A or B, #1 grade:
   a. Boards: Construction grade.

C. Sill Plates (On Concrete): Construction grade light framing, pressure treated as hereinafter specified; as noted on Plans.

D. Plywood for Walls and Roofs; As Noted On Plans:
1. Unless glue type is otherwise specified, exterior plywood, interior plywood exposed to continuing moisture, and pressure treated plywood shall be fabricated with exterior glue. Plywood with interior glue shall be fully protected from soaking or continuing moisture at all times.

E. Rough Hardware:
1. Nails, spikes, bolts, screws, tacks, and framing connectors of standard manufacture as required. Hot dip galvanize items exposed to moisture or to exterior and those items that are in contact with wood pressure treated with waterborne salts:
   a. Bolts and nuts: ASTM A307, Grade A.
   b. Lag bolts: Fed. Spec. FF-B-561. Pre-drill per CBC.
   c. Nails: Fed. Spec. FF-N-101, common unless otherwise noted or specified.
   d. Joist hangers and framing connectors: Simpson or approved equal, unless otherwise noted.
   e. Power driven fasteners: Hilti, Ramset, or approved equal, each use and fastener type subject to prior approval of Architect.

F. Pressure Treatment (Decay and Termite Prevention):
1. Pressure treat for decay and termite prevention, Douglas fir or larch wood materials that are embedded in or set against concrete.
2. Treat in accordance with Reference Standard 1.02 E and quality mark as per Reference Standard 1.02 F.
3. Treat with any of the following processes at Contractor option. Creosote type preservatives are not permitted:
   a. Penta in an LPG carrier (Cellon) or Penta in Hydrocarbon Solvent-Type D (Dow Process) AWPB LP-4 quality marked.
   b. Ammoniacal copper arsenate (ACA) or chromated copper arsenate (CCA) in a water carrier (AWPB LP-2 quality marked).
   c. Disodium Octaborate Tetrahydrate (DOT) such as Advance Guard/Hi-bor by Osmose, Inc.
   d. Members treated with waterborne salts shall be dried to a moisture content not exceeding 19 percent after treatment.
4. Where possible, precut material before treatment.
5. Holes and cutoffs and handling and storage shall be in accordance with AWPA M-4.
6. Ensure that ferrous metal fastenings and items in contact with wood treated with waterborne salts are hot dip galvanized (1.25 oz. coating) where required by ICC

reports.

G. Building Paper and Felt: Kraft waterproof building paper or 15# unperforated asphalt saturated rag felt per CBC Standard 14-1.

H. Framing Connectors: Simpson Strong Tie Corp., or equal.

2.2 MOISTURE CONTENT

A. 19 percent maximum for two times thickness and less; 19 percent maximum for thickness greater than two times and less than four times; and 22 percent maximum for thickness greater than four times.

2.3 SIZES

A. Surfaced to "DRY" sizes. Sizes noted are nominal unless shown as net.

2.4 SURFACING

A. All wood materials exposed in the finished work shall have re-sawn surfaces of clean natural color unless noted or specified otherwise. Concealed framing lumber shall be S4S.

PART 3 EXECUTION

3.1 ERECTION AND INSTALLATION

A. Framing: Conform to CBC where same covers points not indicated on Drawings. Properly lay out framing with pieces closely fitted, accurately plumbed, leveled and aligned, and rigidly secured in place.

B. Except as specifically shown on structural drawings, cutting of all wood, etc. is limited to those cuts permitted by 2022 California Building Code (CBC).

C. Bridging and Blocking: Conform to CBC. Provide two times blocking at intersections of finished surfaces for adequate bearing and at points where required to support fixtures, cabinets, hardware, and other equipment mounted on walls.

D. Plywood (General): Unless more stringent requirements are indicated on the Drawings or required by code, application of plywood shall be in accordance with recommendations of the American Plywood Association.

E. Connections and Fastenings: Conform to CBC. Unless otherwise specified or shown on the Drawings, conform to minimum nailing requirements of CBC. For bolted connections, provide washers under heads and nuts bearing on wood, and draw nuts tight. Retighten before closing in framing. Exercise care in nailing through exposed sheathing and siding and ensure that fasteners penetrate into framing members

END OF SECTION 06 10 00

SECTION 06 10 53 MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Framing with dimension lumber.
   2. Rooftop equipment bases and support curbs.
   3. Wood blocking, cants, and nailers.
   4. Wood furring and grounds.
   5. Wood sleepers and platform wood flooring.
   6. Plywood backing panels.
   7. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than two inches (2”) nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of two inches (2”) nominal (38 mm actual) or greater size but less than five inches (5”) nominal (114 mm actual) size in least dimension.

1.4 SUBMITTALS

A. Product Data:
   1. Submit each type of process and factory fabricated product. Indicate component and materials and dimensions and include construction and application details:
      a. Wood treatment:
         1) Submit data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained:
            a) Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by qualified independent testing agency.
            b) For fire retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
            c) For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to site.

B. Laboratory and Testing Reports:
   1. Laboratory test reports:
      a. Submit report for installation adhesives indicating compliance with requirements for low emitting materials.

b. Post installed anchors.
c. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building code: Comply with applicable requirements of CBC Chapter 23 for miscellaneous wood.
2. Fire retardant treated lumber and plywood by pressure process: Provide products with a flame spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
3. Level floor finishes to minimum requirement noted CBC Section 11B-302.1.

B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber:
1. DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated:
a. Factory mark each piece of lumber with grade stamp of grading agency.
b. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
c. Dress lumber, S4S, unless otherwise indicated.
d. Maximum moisture content of lumber: 19 percent unless otherwise indicated.

B. Preservative Treatment by Pressure Process:
1. AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground:
a. Preservative chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
b. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
c. Kiln dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
d. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

e. Application - treat items indicated on Drawings and the following:
   1) Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2) Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

C. Fire Retardant Treatment:
1. Where indicated as fire retardant treated, provide materials acceptable to authorities having jurisdiction, and with fire test response characteristics specified as determined by testing identical products per ASTM E84 by a qualified testing agency:
   a. Treatment shall not promote corrosion of metal fasteners.
   b. Exterior type: Comply with specified requirements for fire retardant treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   c. Interior Type A: Provide treated materials with moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   d. Design value adjustment factors:
      1) Test treated lumber according to ASTM D5664 and calculate design value adjustment factors according to ASTM D6841:
         a) For enclosed roof framing, framing in attic spaces, and where high temperature fire retardant treatment is indicated, provide material with adjustment factors of minimum 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for climatological zone.
   e. Kiln dry lumber after treatment to a maximum moisture content of 19 percent.
   f. Identify fire retardant treated wood with appropriate classification marking of qualified testing agency:
      1) For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
   g. Application:
      1) Treat items indicated on Drawings and the following:
         a) Framing for raised platforms.
         b) Concealed blocking.
         c) Roof framing and blocking.
         d) Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
         e) Plywood backing panels.

D. Dimension Lumber Framing:
1. Non load bearing interior partitions: Construction or No. 2 grade of any species.
2. Other framing: Construction or No. 2 grade of any species.

E. Miscellaneous:
1. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including but not limited to blocking, nailers, cants, grounds, furring, roof top equipment bases and support curbs, and utility shelving:
   a. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
   b. For blocking not used for attachment of other construction, use utility, stud, or No. 3 grade lumber of any species provided that it is cut and selected to eliminate defects that interfere with attachment and purpose.
   c. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that interfere with attachment of work.
   d. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

e. Utility shelving:
1) Lumber with 19 percent maximum moisture content of any of the following species and grades:
a) Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
b) Mixed southern pine or southern pine No. 2 grade; SPIB.
c) Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

F. Concealed Boards:
1. 19 percent maximum moisture content of any of the following species and grades:
a. Mixed southern pine or southern pine, No. 2 grade; SPIB.
b. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
c. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
d. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
e. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

G. Plywood Backing Panels :
1. Equipment backing panels: Plywood, DOC PS 1, Exterior, C-C Plugged or Exposure 1, C-D Plugged, fire retardant treated, in thickness not less than 3/4-inch (19 mm) nominal thickness.

H. Fasteners:
1. Provide fasteners of size and type indicated that comply with requirements:
a. Where carpentry is exposed to weather, in ground contact, pressure preservative treated, or in area of high relative humidity, provide fasteners with hot dip zinc coating complying with ASTM A153/A153M.
b. Nails, brads, and staples: ASTM F1667.
c. Screws for fastening to metal framing: ASTM C1002 drywall type or ASTM C954 nonload bearing steel stud, length recommended by screw manufacturer for material being fastened.
d. Power driven fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70. (Refer to Structural Drawings)
e. Post installed anchors: (Refer to Structural Drawings)
1) Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 mechanical, masonry, ICC-ES AC58 mechanical, concrete, ICC-ES AC193 adhesive, masonry, or ICC-ES AC308 adhesive, concrete as appropriate for the substrate:
a) Material, interior: Carbon steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
b) Material, exterior: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

I. Metal Framing Anchors:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Cleveland Steel Specialty Co.
b. KC Metals Products, Inc.

c. Phoenix Metal Products, Inc.
d. Simpson Strong-Tie Co., Inc.

2. Galvanized steel sheet: Hot dip, zinc coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation. Use for interior locations unless otherwise indicated.
3. Hot dip, heavy galvanized steel sheet - ASTM A653/A653M; structural steel (SS), high strength low alloy steel Type A (HSLAS Type A), or high strength low alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick. Use for wood preservative-treated lumber and where indicated:
   a. Stainless steel sheet: ASTM A666, Type 304 and Type 316 for exposed application in coastal environments. Use for exterior locations and where indicated.

J. Miscellaneous Materials:
1. Adhesives for gluing to concrete or masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
2. Flexible flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized asphalt compound, bonded to high density polyethylene film, aluminum foil, or spunbonded polyolefin to produce overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA WCD 1 Details for Conventional Wood Frame Construction unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels:
1. Install fire retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim:
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2,438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks

of same width as framing members and two-inch nominal (2") (38-mm actual) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 square feet (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

H. Sort and select lumber so natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative treated lumber:
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1 Fastening Schedule in the International Building Code.
2. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

L. Wood Blocking and Nailer Installation:
1. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved:
   a. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
   b. Provide permanent grounds of dressed, pressure preservative treated, key beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.2 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work. During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

B. Waste Management:
1. Refer to Section 01 74 19: Construction Waste Management and Disposal, and Construction Waste Management Plan:
   a. Select lumber sizes to minimize waste; reuse scrap lumber to the greatest extent possible. Clearly separate scrap lumber for use onsite as accessory components, including shims, bracing, and blocking.
   b. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
   c. Prevent sawdust and wood shavings from entering the storm drainage system.
   d. Do not burn scrap lumber that has been pressure treated.
   e. Do not send lumber treated with pentachlorophenol, CCA, or ACA to cogeneration facilities or waste to energy facilities.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron treated wood becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA registered borate treatment. Apply borate solution by spraying to comply with EPA registered label.

END OF SECTION 06 10 53

SECTION 06 16 00 SHEATHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Wall sheathing.
   2. Underlayment.
   3. Sheathing joint and penetration treatment.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data for each type of process and factory fabricated product. Indicate component materials and dimensions and include construction and application details:
      a. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
      b. Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
      c. For fire retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
      d. For products receiving a waterborne treatment, include statement that moisture content of treated materials reduced to levels specified before shipment to Project site.
      e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

A. Fire Test Response Characteristics:
   1. For assemblies with fire resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction:
      a. Fire resistance ratings: Indicated by design designations from UL Fire Resistance Directory or GA-600 Fire Resistance Design Manual.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Plywood: DOC PS 1.

B. Oriented Strand Board: DOC PS 2.

C. Thickness: As necessary to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE TREATED PLYWOOD

A. Preservative Treatment by Pressure Process - AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground:
   1. Preservative chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE RETARDANT TREATED PLYWOOD

A. Where fire retardant treated materials are indicated, use materials complying with requirements acceptable to authorities having jurisdiction and with fire test response characteristics specified determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire Retardant Treated Plywood by Pressure Process:
   1. Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test:
      a. Use treatment that does not promote corrosion of metal fasteners.
      b. Exterior type: Treated materials shall comply with requirements specified above for fire retardant treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
      c. Design value adjustment factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high temperature fire retardant treatment is indicated, span ratings for temperatures up to 170 degrees F (76 degrees C) shall be not less than span ratings specified.

C. Kiln dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire retardant treated plywood with appropriate classification marking of qualified testing agency.

E. Application:
   1. Treat plywood indicated on Drawings and the following:
      a. Roof and wall sheathing within 48 inches (1,220 mm) of fire walls.
      b. Subflooring and underlayment for raised platforms.

2.4 WALL SHEATHING

A. Glass Mat Gypsum Wall Sheathing - ASTM C1177/C1177M:
   1. Product is subject to compliance with requirements; provide products by one of the following:
      a. CertainTeed Corporation: GlasRoc (basis of design).
      b. Georgia Pacific: Dens-Glass.
      c. National Gypsum Company: Gold Bond eXP.
      d. United States Gypsum Co.: Securock.
   2. Type and thickness: Regular, 1/2 inch (12.7 mm) thick.
   3. Size: Four feet by eight feet (1,220 mm by 2,440 mm) for vertical installation.

2.5 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor Underlayment - DOC PS 1, Exterior, Structural I, C-C Plugged Single Floor Panels:
   1. Span rating: Not less than 20 o.c.
   2. Nominal thickness: Not less than one inch (25 mm).
   3. Edge detail: Tongue and groove.
   4. Surface finish: Fully sanded face.

B. Underlayment: Provide underlayment in nominal thickness not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.

C. Sound Deadening Board - Class C Fire Rated, Molded, Recycled Post-Consumer Paper, Cellulose Fiber Structural Panel:
   1. Density: 26 pcf to 28 pcf (416 = 448 kg/cu.m) tested in accordance with ASTM C209.
   2. Tensile strength - when tested in accordance with ASTM C209:
      a. Parallel: 450 - 700 psi (3,100 - 4,830 kPa).
      b. Transverse: 750 - 1--- psi (5.1171 - 6.894 kPa).
   3. Hardness (Janka Ball): 230 pounds (104 kg) tested in accordance with ASTM D1037.
   4. Water absorption by volume, when tested in accordance with ASTMC209:
      a. Two-hour immersion: Maximum seven percent (7%).
   5. Expansion: 50 percent to 90 percent relative humidity, 0.25 percent in accordance with ASTM C209.
   6. Noise reduction coefficient (NCR): 0.20.
   7. Flame spread: Maximum 75 tested in accordance with ASTM E84 Class C.
   8. Thickness: 3/4 inch (19 mm).

2.6 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture. Provide fasteners with hot dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Gypsum Sheathing to Cold Formed Metal Framing:
   1. Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic polymer or corrosion protective coating having salt spray resistance of more than 800 hours according to ASTM B117:
      a. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C1002.

2.7 SHEATHING JOINT AND PENETRATION TREATMENT MATERIALS

A. Sealant for Glass Mat Gypsum Sheathing:
   1. Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass fiber sheathing tape and for covering exposed fasteners:
      a. Sheathing tape: Self-adhering glass fiber tape, minimum two inches (50 mm) wide, ten by ten or ten by 20 threads/inch (390 by 390 or 390 by 780 threads/m) of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass mat gypsum sheathing and with history of successful in-service use.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

B. Dry-Rot Repair: For existing Wood Frame Studs, Glue-Lam Beams and Plywood Sheathing.
   1. Use Clear Penetrating Epoxy Sealer Products – Field applied
   2. Do NOT thin any product used unless the manufacturer suggest. Follow instructions.
   3. Replace with new frame and sheathing where damage exceeds 15% or as inspected and recommended.
   4. Replace ALL structural members where dry-rot is present.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three (3) support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint sealant installation so materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions. Fasten gypsum sheathing to cold formed metal framing with screws. Install boards with a 3/8-inch (9.5 mm) gap where non-load bearing construction abuts structural elements. Install boards with a 1/4-inch (6.4 mm) gap where they abut masonry or similar materials that retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation:
   1. Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud:
      a. Space fasteners approximately eight inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer's written instructions. Apply glass fiber sheathing tape to glass mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal penetrations and openings.

END OF SECTION 06 16 00

SECTION 06 20 00 FINISH CARPENTRY AND MILLWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Providing all finish carpentry items including, but not limited to:
   a. Finish carpentry.
   b. Millwork and cabinetry.
   c. Solid Surface Countertop.
   d. Plastic laminate.
   e. Casework hardware.
   f. Miscellaneous millwork.
2. Installation of:
   a. Finish hardware.
   b. Plastic laminate faced wood doors.

B. Related Sections:
1. Section 05 50 00: Metal Fabrications.
2. Section 06 10 00: Rough Carpentry.
3. Section 08 71 00: Door Hardware.
4. Section 09 21 16: Gypsum Board Assemblies.
5. Section 13 34 23: Pre-Engineered Modular Buildings.

C. Reference Standards:
1. Codes and references:
   a. 2022 California Building Code Section 11B-309.
   b. American Disabilities Act Design Guidelines (ADADG).
2. American National Standards Institute:
   a. ANSI A156.9 Cabinet Hardware.
   b. ANSI A161.1 Woodwork Testing Standards.
   c. ANSI A208.1 Mat-Formed Wood Particleboard.
3. Woodwork Institute:
   a. WI North American Architectural Woodwork Standards (current edition).
4. National Electrical Manufacturers Association:
   a. NEMA LD 3 High Pressure Decorative Laminates.

1.3 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Manufacturer’s preprinted product information for all hardware proposed on the Project.
3. Manufacturer’s preprinted maintenance instructions for the casework hardware.

B. Shop Drawings:
1. Indicate size, material, and finish.

2. Show locations and installation procedures, including hardware, sinks, service fixtures, trim, and other pertinent data for each unit.

C. Certification: Provide manufacturer's certification that casework has been fabricated and installed according to WI "Custom" Grade guidelines or better.

D. Samples: Two (2) each, six-inch by six-inch by ¾-inch (6" x 6" x 3/4") sample of specified particleboard core with grade stamp for use as verification of installed product.

E. Closeout:
1. Record drawings: Indicate revisions to original Drawings and shop drawings.
2. Manufacturer contact names, addresses, and phone numbers.
3. Finish material schedule: Names and color numbers of laminates and stains.
4. Keys: Provide additional master key for each room and additional locksets totaling one percent (1%) of total Project for attic stock.

1.4 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated, perform work in accordance with WI "Architectural Woodwork Standards," Custom Grade, except where specification exceeds those standards the more stringent shall govern.

B. Fabricate millwork and cabinetry in accordance with ANSI A161.1, NEMA LD3, and general static load testing performed and certified by an independent testing agency covering the following areas of product performance, with these minimum results:
1. Base cabinet construction/racking test: 800 pounds.
2. Cabinet front joint loading test: 425 pounds.
3. Wall cabinet static load test: 2,000 pounds.
4. Drawer front joint loading test: 600 pounds.
5. Drawer construction/static load test: 750pounds.
6. Cabinet adjustable shelf support device/static load test: 300 pounds.

C. Shelf Loading: Comply with loading/deflection standards of the Composite Panel Association.

1.5 QUALITY ASSURANCE

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

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

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

Certificate indicating millwork products being furnished for this Project and certifying that these products and their installation will fully meet requirements of grade or grades specified.

b. Each elevation of casework and each countertop shall bear certified compliance label.
c. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.

D. Certified Seismic Installation Program (CSIP):
1. Before wood or metal stud walls are closed up, provide a written Woodwork Institute CSIP report confirming that acceptable backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located:
   a. Backing shall consist of a minimum of either three by six (3 x 6) flat Douglas Fir or 16-gage 50 KSI sheet metal.
2. On completion of installation, provide a Woodwork Institute CSIP Certificate identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.
3. All fees charged by the Woodwork Institute for their CSIP are the responsibility of the millwork installer and shall be included in their bid.

E. Pre-Installation Conference:
1. See Section 01 31 00: Project Management and Coordination.

1.6 WARRANTY

A. Warranty the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include but not be limited to the following:
1. Rough or difficult operation, or loose or missing parts.
2. Delamination of surfaces.
3. Noticeable deterioration of finish.
4. Warped or misaligned surfaces or telegraphing of subsurface imperfections.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed. Store in ventilated place, protected from the weather, with relative humidity range of 20 to 50 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

PART 2 PRODUCTS

2.1 MILLWORK MANUFACTURERS

A. Woodwork Institute listed Accredited Millwork Companies, current roster and shall not preclude Contractor from using other manufacturers, provided they produce equivalent products of the type specified for the scope and size of the Project. Other manufacturers must have experience manufacturing products meeting or exceeding the specifications and must comply with the criteria performance set by the Woodwork Institute or as indicated in Part 1 of this Section and with Division 01 requirements regarding substitutions.

2.2 MILLWORK MATERIALS

A. Plastic Laminate:
1. High-pressure decorative laminate complying with NEMA LD3, and the following requirements:
   a. Exterior color selection available:
      1) Architect to select from minimum of 250 selections available, including wood grain patterns and solid colors.
      2) Provide five (5) different colors available per project.
      3) If laminate has wood grain, direction of grain shall be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.
2. Laminate grades:
   a. Exposed doors, finished end panels, and other vertical surfaces: GP28 (0.028 inch thick nominal)
   b. Horizontal surfaces other than top: GP28 (0.028 inch thick nominal)
   c. Cabinet liner: CL20 (0.020-inch nominal), white.
   d. Work surfaces and countertops: GP50 (0.050-inch thick nominal) with BK20 (0.20-inch thick) backer sheet.
   e. Backsplash: PH42 (0.042 inch nominal) with nominally balanced backer sheet.
3. Adhesive: PVA water resistant adhesive. Contact adhesives not permitted.
4. Pressure fused laminate:
   a. NEMA LD3 VGL, and NEMA LD3 CLS, melamine resin impregnated, 120-gram PSM minimum, thermofused to core under pressure.
   b. Color:
      1) Closed interiors, underside of wall cabinets: White.
      2) Exposed and semi-exposed open cabinets: Match exterior.
   c. Provide balanced construction with same thermofused melamine. Unsurfaced coreboard or simple backers not allowed.

B. Core Material:
1. Particleboard: ANSI 208.1, Grade M-2-Exterior Glue.
2. Medium-density fiberboard: ANSI A208.2, Grade MD.
3. Plywood: Shop sanded, exterior grade veneer cored, hardwood faced, any species, with no defects affecting strength or utility. Overlay plywood not permitted. Plywood allowed at countertops and toe-base only.
4. Water resistant treated plywood shall have 24-hour thickness swell factor of five percent (5%) or less and 24-hour water absorption factor of ten percent (10%) or less; P.S. 51, Type II or better.
5. Cabinet components shall be of the following minimum core thicknesses:
   a. Cabinet backs, drawer body, and drawer bottoms: ½-inch particleboard.
   b. Door and drawer face, base, wall, and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, cabinet back rear hangstrips, structural dividers, and exposed cabinet backs: 3/4-inch particleboard.
   c. Work surfaces and countertops: Minimum one-inch (1”) particleboard or plywood, except use water resistant treated plywood core at counters with sinks.
   d. Shelves: 3/4-inch particleboard core for 30 inches long or less, one-inch (1”) thick particleboard core for more than 30 inches long; 14-inch deep, unless otherwise noted. Provide vertical dividers for shelves over 36 inches long.
   e. Cabinet toe-base: 3/4-inch plywood. No particleboard within four inches (4”) of floor.

C. Countertops - WI Premium Grade: Where indicated on Drawings.
1. Solid Surface:
   a. Solid surfacing material thickness: ¾-inch (19 mm).
   b. Backsplash to match countertops, min 4 inches unless otherwise indicated on

Drawings.
c. Colors, patterns, and finishes: Provide materials and products resulting in colors of solid surfacing material indicated on Drawings.

2. Quartz countertops:
   a. Seams:
      1) Fabricate countertops without seams to the extent possible. When seams are necessary, fabricate countertops in sections indicated for joining in field, with sealant filled seams 1/16-inch (1.5 mm) in width.
   b. Fittings: Drill countertops in shop for fittings and similar items.
   c. Fabricate with four-inch (4”) backsplashes. Sand minor scratches and stains with #400 then #600 sandpaper.
3. Fabrication:
   a. Fabricate tops in one piece, unless otherwise indicated. Comply with solid surfacing material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing:
      1) Fabricate tops with shop applied edges of materials and configuration indicated.
      2) Fabricate tops with loose backsplashes for field application.
   b. Drill holes in countertops for plumbing fittings and soap dispensers in shop.
4. Countertop construction tolerances:
   a. Variation from plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1,200 mm).
   b. Variation from level: Do not exceed 1/8 inch in 96 inches (3 mm in 2,400 mm), 1/4-inch (6 mm) maximum.
   c. Variation in joint width: Do not vary joint thickness more than 1/4 of nominal joint width.
   d. Variation in plane at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between planes of adjacent units.
   e. Variation in line of edge at joints (lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

D. Countertops and Backsplashes:
1. Countertops: Where indicated on Drawings; provide countertops with rolled edges in as long as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inches either side of sink cutout.
2. Backsplash: Integral to countertop, four inches (4”) high unless otherwise shown. Fabricate with single continuous sheet of laminate from front counter to top of splash with no joints from horizontal to vertical application. No joints shall occur at sink openings.
3. At exposed countertop end corners, provide one-inch (1”) radius, or similar safety treatment.

E. Toe Spaces: Leave toe spaces unfinished for installation of resilient base, unless otherwise shown.

F. End Panels and Filler Strips: Match adjacent case-piece.

G. Edging:
1. Provide the following in accordance with “Edging Locations:”
   a. Flat edge PVC: 0.020 inch. Solid, high-impact, purified, color-thru, acid resistant, machine-applied with hot melt adhesives.
   b. Three-millimeter (3 mm) PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, and machine profiled to 1/8-inch radius.
2. Edging locations:
   a. Cabinet body edge, including door/drawer front spacer rail: Flat edge PVC, color

matched to door/drawer face or as selected.
b. Forward edge of interior body components, interior dividers, shelf, and top edges of drawer body: Flat edge PVC to match cabinet interior surface color.
c. Door/drawer-front edging: Three-millimeter (3 mm) PVC, color matched to standard laminates.

2.3 CABINET HARDWARE

A. All hardware shall meet ANSI A156.9 and shall be subject to approval by the Architect. All keying shall match existing master key system and be approved by the Owner:
1. Acceptable manufacturers:
a. Knape & Vogt.
b. As specified herein, provide specified product, or Architect approved equal.

B. Hinges:
1. Heavy duty, five-knuckle 2-3/4-inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, Teflon coated tight pin feature with all edges eased. Hinge shall be full wrap around type of tempered steel 0.095 inch thick. Each hinge shall have minimum of nine (9) screws, #7, 5/8-inch FHMS to assure positive door attachment.
2. One (1) pair per door to 48 inches height. 1-1/2 pair over 48 inches in height. Hinge shall accommodate 13/16 thick laminated door and allow 270-degree swing.
3. Finish: US26D.

C. Pulls: Wire design, four inches (4”), satin chrome, US26D finish.

D. Sliding Door Hardware:
1. Frameless 1/4-inch glass sliding doors; double track rolling door assembly.
2. Framed 13/16-inch thick stile and rail sliding doors; top mounted track with dual roller hangers. Vertical adjustment for accurate alignment.

E. Drawer Slides:
1. Standard drawers: 3/4 extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 100-pound dynamic load rating at full extension.
2. File drawers: Full extension, three-part progressive opening slide, precision steel ball bearing, minimum 100-pound dynamic load rating at full extension, zinc plated or epoxy coated at manufacturer’s option.
3. Provide body mounted molded rails for hanging file system for legal or letter size as indicated by manufacturer’s model number. Cutting or machining of drawer body/face not permitted.
4. Paper storage drawers: Full extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 150-pound dynamic load rating at full extension.

F. Catches:
1. Provide opening resistance in compliance with the Americans with Disabilities Act:
a. Provide top-mounted magnetic catch for base and wall cabinet door.
b. Provide two (2) at each tall cabinet door. Catch housing shall be molded in White.

G. Adjustable Shelf Supports:
1. Dual-pin design with anti-tip-up shelf restraints for both ¾-inch and one-inch (1”) shelves.
2. Include keel to retard shelf slide-off, and slot for mechanical attachment of shelf to clip.
3. Load rating shall be minimum 300 pounds each support without failure.

H. Wardrobe Rod: 1-1/6-inch diameter plated steel rod, with captive sockets.

I. Coat Hooks: Single and double prong, wall mount - satin aluminum.

J. Locks: Five-disk tumbler cam-style with strike. Locks on cabinets in same room keyed alike. Provide two (2) keys per room where doors and drawers are scheduled to receive locks. Dull chrome finish. Lock core shall be removable with a control key, permitting Owner to change lock arrangements without tools.

2.4 SPECIALTY ITEMS

A. Grommets:
1. Approved Product/Manufacturer: Model No. EDP3 manufactured by Doug Mockett & Company, Inc. (basis of design), Manhattan Beach, CA; (800) 523-1269, or Architect approved equal.
2. Size: 2-1/2 inches diameter with “Flip-Top”™ tab in cap.
3. Colors: As selected by Architect from manufacturer’s available colors.
4. Number/location: Where electrical, telephone, and computer data wiring need to pass through tops whether shown or not.

B. Keyboard Drawers (at all knee spaces):
1. Approved product/manufacturer: No. SD-1 as manufactured by Knape & Vogt; or Architect approved equal.

C. Molded Personal Pencil Drawer: High-impact 100 Polystyrene with in-stop, out-stop, and self-closing features. Provide under top mounted 100-pound self-closing slides. Twelve (12) compartment drawer body, and slides, black. Provide where indicated on plans.

D. Mailbox Label Holder: Brass, card size 1/2-inch by 2-3/16 inches. Provide one (1) at each opening.

2.5 SOLID STOCK

A. Moisture Content: Percent of moisture in relation to over-dry weight shall be between eight percent (8%) and 13 percent at time of installation.

B. Natural Finish Hardwood:
1. Occasional knot permitted provided it is tight and smooth.
2. Grain pattern: Rift-cut.
3. Species: WI "Premium" Grade, white oak.

C. Paint Grade Hardwood: Any species, including Parana Pine, except do not use oak, elm, or similar species that have coarse grain.

2.6 MISCELLANEOUS

A. Utility Shelving: WI "Economy" grade.

B. Clothes Rod: 1-1/2 inch diameter smooth wooden dowel by length required, with end supports and fasteners of type recommended to suit application.

C. Telephone/MDF/IDF Board: Provide minimum four foot by eight foot by ¾-inch (4’ x 8’ x 3/4”) thick plywood for telephone/data punch down blocks and video equipment in accordance with Section 06 10 00: Rough Carpentry. Paint in accordance with Section 09 90 00: Painting and Coating.

2.7 MILLWORK FABRICATION

A. Use the WI Custom Grade woodwork classification unless noted elsewhere complying with referenced quality standard.

B. Fabricate casework, countertops, and related products to dimensions, profiles, and details shown on Drawings. Fabricate casework square, plumb, and true.

C. Detailed Requirements for Cabinet Construction:
   1. Toe-base:
      a. Continuous, ladder type platform with concealed fastening to cabinet bottom, level and secured to floor.
      b. Toe-base at exposed cabinet end panels shall be recessed ¼-inch from face of finished end for flush installation of finished base material.
      c. No cabinet sides-to-floor will be allowed.
   2. Cabinet top and bottom:
      a. Solid sub-top shall be furnished for all base and tall cabinets.
      b. At cabinets over 36-inches, bottoms and tops shall be mechanically joined by a fixed divider.
      c. Assembly devices shall be concealed on bottom side of wall cabinets.
   3. Cabinet sides:
      a. Doweled, and glued under pressure, or attached with fully concealed interlocking mechanical fasteners to sub-top and bottom.
      b. Drill holes for adjustable shelves 1-1/4 inch on center.
   4. Cabinet backs:
      a. Side bound, captured in grooves, recessed from cabinet rear, and securely fastened at top and bottom.
      b. Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of two (2) at base, two (2) at wall, and three (3) at tall cabinets as instructed by casework manufacturer.
      c. Provide removable back panels and closure panels for plumbing access at all sink cabinets, and where shown on Drawings.
   5. Exposed end corner and face frame attachment:
      a. Butt joint, glued and finish nailed; or attached with fully concealed interlocked mechanical fasteners.
   6. Door and drawer fronts:
      a. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8-inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
      b. Where indicated, provide stile and rail doors with full 1/4-inch plate glass, hinged or sliding. Exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.
      c. Where indicated, frameless sliding glass doors shall be 1/4-inch thick plate glass with ground and polished edges. Fit with anodized aluminum shoes and nylon rollers.

D. Drawers:
   1. Drawer fronts: Apply to separate drawer body component sub-front.
   2. Drawer sides: Doweled to receive front and back, glued under pressure, machine squared.
   3. Drawer bottom: Set into front and sides, 1/4-inch deep groove with minimum 3/8-inch standing shoulder, continuously glued. Reinforce drawer bottoms with ½-inch by four-inch (4”) front-to-back intermediate underbody stiffeners, mechanically fastened. One (1) at 24 inches, two (2) at 36 inches, and over.
   4. Paper storage drawers: Fitted with full width hood at back.
   5. Hanging file drawers shall be fabricated to accept letter size hanging folders

compatible with Pendaflex system.

E. Vertical and Horizontal Dividers: As required by manufacturer for type and style of component.

F. Door/Drawer Front Rail: As required by manufacturer for type and style of component, and hardware placement.

G. Accessibility Requirements - 2022 California Building Code, Section 11B:
1. The following special requirements shall be met, where specifically indicated on architectural Plans as “accessible” or by general note. Shall be in compliance with California title 24 access:
   a. Countertop height: With or without cabinet below, not to exceed a height of 34 inches above finished floor (A.F.F.), at a surface depth of 24 inches.
   b. Knee space clearance: Minimum 27 inches A.F.F. at apron, and 30 inches clear span width (11B-306.3).
   c. Sink cabinet clearances: In addition to above, upper knee space frontal depth shall be no less than eight inches (8”), and lower toe frontal depth shall be no less than 11 inches, at a point nine inches (9”) A.F.F., and as further described in 11B-306.

H. Typical Desk or Counter Height at Knee Space Locations: 30 inches A.F.F.

PART 3 EXECUTION

3.1 JOB CONDITIONS

A. Environmental Requirements:
1. Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least one (1) week:
   a. Manufacturer/supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
   b. After installation, control temperature and humidity to maintain relative humidity between 25 and 55 percent.

B. Conditions: Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

3.2 COORDINATION

A. Coordinate the work of this Section with plumbing work specified in Division 22. Coordinate sink opening construction with sinks specified in Division 22 or as indicated on Drawings.

B. Coordinate location of blocking in walls for installation and support of wall cabinets.

3.3 MILLWORK INSTALLATION

A. Positioning: Place approximately level, plumb, and at right angles to adjacent work.

B. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging the products and adjacent work.

C. Anchorage: Attach securely so the products will perform to their maximum ability without damage from inadequate fastenings.

D. Fasten tops to frames with concealed clips, screws, and glue.

E. Install simulated wood trim in locations shown on Drawings and in accordance with manufacturer's instructions.

3.4 EXISTING DOOR LAMINATE RESURFACING

A. Resurfacing procedures shall be in accordance with the recommendations and instructions of the laminate and adhesive manufacturers.

B. Acclimate laminate to the same environment as existing material at least 48 hours. Perform work in well-ventilated area, out of the way of construction dust and traffic to maintain clean adhesion.

C. Clean the substrate with detergent or non-flammable solvent as instructed by laminate manufacturer to remove wax, grease, and polish deposits.

D. Using a belt sander or sander instructed by manufacturer, sand entire surface to remove original finish. Remove sanding dust thoroughly.

E. Coat the sanded surface and back of laminate with a uniform coating of contact adhesive. Allow to dry thoroughly prior to assembling. Assembling wet adhesive lines will trap solvent and may result in poor bonding. Follow the adhesive manufacturer's instructions.

F. Index the laminate with the substrate. Make initial contact by smoothing with palms. Apply pressure using a "J" roller or rotary press. Allow to set as instructed by adhesive manufacturer to achieve full adhesion to maintain warranty. Trim with recommended tools.

G. Apply laminate to door faces and exposed vertical edges. Apply edges before face. Paint top and bottom edges to color match facing.

H. Coordinate hardware and vision lite cutouts with work of other Sections.

3.5 FINISH HARDWARE INSTALLATION

A. The supplier will mark each item of hardware for location. Protect the markings until each item is installed. If any item is delivered to the job not properly marked, return it to the supplier for marking before attempting to install it.

B. Check markings on hardware for proper location. Install and make necessary adjustments for proper working order. Any hardware damaged by improper adjustment or careless abuse will be replaced by Contractor at his expense.

C. Provide clean, properly sized, and accurately placed mortises and drilled holes for all mortise hardware such as locksets and for cylindrical locks where specified only.

D. Fit all surface-applied hardware accurately.

E. After hardware is installed, protect exposed surfaces by use of heavy paper and masking tape and maintain until job completion.

F. Remove all finish hardware except that which is primed for painting before painter's finish is applied. Permanently replace and re-adjust for proper function after painter's finish has dried hard.

G. Millwork contractor shall be responsible for hardware on millwork.

3.6 PLASTIC LAMINATE FACED WOOD DOOR INSTALLATION

A. Protect all doors during handling.

B. Install doors in accordance with manufacturer's instructions.

C. Install and adjust doors for smooth, quite operation.

D. Refer to Section 08 81 00 Door Hardware where applicable.

END OF SECTION 06 20 00

SECTION 06 40 00 ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Plastic laminate cabinets.
2. Plastic laminate and solid surface countertops.
3. Plastic laminate panels.
4. Standing and running trim.
5. Closet and utility shelving.
6. Shop finishing.
7. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 06 10 00: Rough Carpentry.
2. Section 06 20 00: Finish Carpentry and Millwork.
3. Section 09 90 00: Painting and Coating.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

A. Product Data:
1. Technical data for each type of product indicated including cabinet hardware and accessories:
a. Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components:
a. Show details full size.
b. Show locations and sizes of furring, blocking, and hanging strips including concealed blocking and reinforcement specified in other Sections.
c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.

C. Samples:
1. Lumber with or for transparent finish, not less than five inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on one (1) side and one (1) edge.
2. Veneer faced panel products with or for transparent finish, eight inches by ten inches (200 by 250 mm), for each species and cut. Include at least one (1) face veneer seam

and finish as specified.

3. Lumber and panel products with shop applied finish, 50 square inches (300 sq. cm) for lumber and eight inches by ten inches (200 mm by 250 mm) for panels, for each finish system and color, with 1/2 of exposed surface finished.
4. Plastic laminates, eight inches by ten inches (200 mm by 250 mm), for each type, color, pattern, and surface finish and specified edge material applied to one (1) edge.
5. Quartz surfacing materials, six inches (6") square.
6. Corner pieces:
   a. Cabinet front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by six inches (150 mm) deep.
7. Exposed cabinet hardware and accessories, one (1) unit for each type and finish.

D. Qualification Data: For fabricator/installer.

E. Woodwork Quality Standard Compliance Certificates: Woodwork Institute (WI) Quality Certification Program certificates (CCP).

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building code: Comply with applicable requirements of CBC Chapter 8 for Interior Finishes.
   2. Accessibility:
      a. 2022 California Building Code; Section 11B-309 for Casework, Section 11B-404 Doors and Hardware and Section 11B-703 for Signage (where applicable).
      b. ADA Accessibility Guidelines (ADAAG) for Buildings and Facilities; final guidelines and revisions.
   3. Quality standard: Unless otherwise indicated, comply with WI for premium grade architectural woodwork indicated for construction, finishes, installation, and requirements. Provide certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
   4. Fire test response characteristics: Where fire retardant materials or products are indicated, provide materials and products with specified fire test response characteristics determined by testing identical products per test method indicated by UL. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

B. Fabricator Qualifications: Shop having minimum five (5) years' documented experience who employs skilled workers who custom fabricate products similar to those required and who is a participating member of WI.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence matched wood veneers and transparent finished wood doors that are required to be of same species as woodwork.

D. Quality Standard: Unless otherwise indicated, comply with North American Architectural Woodwork Standards, meeting or exceeding ANSI A161.1, for grades of architectural woodwork indicated for construction, finishes, installation, and requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork is completed in installation areas. If woodwork must be stored in other than installation

areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials that comply with requirements of WI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products:
1. Hardboard: AHA A135.4.
2. Medium density fiberboard:
   a. ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde; minimum 48 pcf density except that minimum for screw holding capacity on face shall be 300 pounds; minimum 3/4 inches (19 mm) thick, edged and faced as specified:
      1) Arauco; Trupan MDF, VESTA Technology.
      2) Roseburg Forest Products, Inc.; Roseburg MDF products.
      3) Approved equal.
3. Particleboard: Unless otherwise noted by District, particleboard is not to be used.
4. Softwood plywood: DOC PS 1, medium density overlay.

C. Lumber:
1. Comply with applicable provisions for grading and workmanship of WI Quality Standards, and requirements specified. Provide lumber surfaced 4 sides (S4S) and fabricated to profiles shown. Kiln dry lumber to 19 percent moisture content:
   a. Furring, blocking, and shims: No. 1 Common; Southern Pine.
   b. Solid hardwood for opaque finish: Plain sawn Yellow Poplar, free from checks, splits, and sound knots.

D. Thermoset Decorative Panels:
1. Particleboard or medium density fiberboard finished with thermally fused, melamine impregnated decorative paper complying with LMA SAT-1:
   a. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.

E. High Pressure Decorative Laminate - NEMA LD 3, grade indicated or as required by woodwork quality standard:
1. Manufacturer is subject to compliance with requirements; provide high pressure decorative laminates by one of the following:
   a. Abet Laminati, Inc.
   b. Formica Corporation.
   c. Panolam Surface Systems by Panolam Industries International Incorporated.
   d. Wilsonart LLC.

2.2 FIRE RETARDANT TREATED MATERIALS

A. Where fire retardant treated materials are indicated, use materials complying with requirements acceptable to authorities having jurisdiction, and with fire test response characteristics specified:
1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or defective.
2. Use fire retardant treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from

untreated materials.

3. Identify fire retardant treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire Retardant Particleboard:
   1. Panels complying with requirements, made from softwood particles and fire retardant chemicals mixed together at time of panel manufacture to achieve flame spread index of 25 or less and smoke developed index of 50 or less per ASTM E84:
      a. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: Modulus of rupture, 1,600 psi 11 MPa; modulus of elasticity, 300,000 psi 2,070 MPa; internal bond, 80 psi 550 kPa; and screw-holding capacity on face and edge, 250 and 225 lbf 1,100 and 1,000 N, respectively.
      b. For panels 13/16 inch to 1-1/4 inches (20 to 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: Modulus of rupture, 1,300 psi 9 MPa; modulus of elasticity, 250,000 psi 1,720 MPa; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf 1,100 and 780 N, respectively.
      c. Product: Subject to compliance with requirements, provide Duraflake FR by Arauco.

C. Fire Retardant Fiberboard: Medium density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire retardant chemicals mixed together at time of panel manufacture to achieve flame spread index of 25 or less and smoke developed index of 200 or less in accordance with ASTM E84.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers of items referenced to this standard. Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type) - BHMA A156.9, B01602, Self-Closing:
   1. Provide 170-degree minimum opening capabilities. For end doors perpendicular to walls, provide 90-degree type.
   2. For doors 32 inches high or less, provide two (2) pairs of hinges, add 1/2 pair for every additional 20 inches.
   3. Products are subject to compliance with requirements; provide from one of the following:
      a. Hafele North America Co.
      b. Julius Blum, Inc.
      c. Mepla-Alfit, Inc.

C. Wire Pulls: Back mounted, solid metal, five inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.

D. Catches - Magnetic, Complying with BHMA A156.9 and B03161:
   1. Rockwood 901 by Assa Abloy.
   2. Comparable product.

E. Cabinet Shelf Rests - Nickel plated, 7 mm diameter shelf support pegs in brass sockets, complying with BHMA A156.9, B04013:
   1. Hafele 282.01.701 x 282.50.704 or comparable product.

F. Closet Rods and Flanges: 1-1/2-inch diameter, satin finished chrome plated steel or satin finished stainless steel with matching end flanges.

G. Adjustable Shelf Standards and Brackets for Wall Hung Open Shelving - BHMA A156.9, B04071; With Shelf Rests, B04081:
   1. Standards: Model No. 87ANO Super Duty 87/186/187 Steel Series; lengths as indicated, by Knape & Vogt or comparable product.
   2. Brackets: Model No. 187 LL ANO 12 to 24 for 12-inch to 24-inch (300 mm to 600 mm) deep shelves by Knape & Vogt or comparable product.
   3. Shelf rests: Model No. 210 ANO End Rest and Model No. 211 ANO Center Rest with Model No. 129 RUB Rubber Cushions or comparable product.

H. Shelf Rests: BHMA A156.9, B04013; metal, two pin type with shelf hold down clip.

I. Silencers:
   1. Provide rubber silencers on jamb and/or head and sill strike areas of all cabinet doors and drawers, two (2) for paired doors, and three (3) for single doors:
      a. Size: Approximately 1/4-inch (6.4 mm) diameter.
      b. Color: Compatible with adjacent finish.

J. Drawer Slides - BHMA A156.9, B05091:
   1. Provide positive stop, self-closing side mounted, full extension, zinc plated steel drawer slides with steel ball bearings:
      a. Pencil drawer slides: Grade 1; for drawers not more than three inches (75 mm) high and 24 inches (600 mm) wide; Accuride 2006 having 3/4 extension carburized steel ball bearing, side mounting, 45-pound capacity medium duty load rating, cold rolled steel slide members and ball retainers, bright electro zinc plate finish.
      b. Box drawers (less than eight inches [8”] deep): Grade 1HD-100; for drawers not more than six inches (150 mm) high and 24 inches (600 mm) wide. Provide Accuride 4034; up to 24 inches wide, full extension carburized steel ball bearing, side mounting, 150-pound capacity medium duty load rating, cold rolled steel slide members and ball retainers, cushioned in and out stops, detent-in, progressive action, positive stop, clear zinc finish.
      c. Pedestal drawers (greater than eight inches [8”] deep): Accuride 4032; up to 24 inches wide, full extension carburized steel ball bearing, rail mounting, minimum 150-pound capacity heavy duty load rating, cold rolled steel slide members and ball retainers, cushioned in and out stops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
      d. Lateral file drawer slides: For drawers more than six inches (150 mm) high or 24 inches (600 mm) wide; heavy-duty, up to 42 inches wide, 3640A by Accuride.
      e. Keyboard slide: Model No. 2109, color black, by Accuride, Inc.
      f. Refuse cabinets: Accuride C3600-201D, full extension carburized steel ball bearing, bracket mounting, heavy-duty, cold rolled steel slide members and ball retainers, cushioned in and out stops, progressive action, positive stop, clear zinc plate finish.

K. Door and Drawer Locks:
   1. Provide locks for each cabinet door and drawer as indicated on Drawings. Finish exposed portions of locks to match cabinet pull finish. Furnish two (2) keys with each lock and key locks inside one room alike and provide master key for locks in Project. Selections to meet BHMA A156.11 and E07041 (for drawers) or E07121 (for doors):
      a. Cam lock similar to Hafele 235.20.20x, chrome plated, with offset cam 219.13.9xx, sized to fit opening.
      b. Cam lock similar to Hafele 235.20.20x, chrome plated, with surface mounted strike 251.60.703.
      c. Pairs of doors:

1) Inactive leaf: Furniture bolt similar to Hafele 252.02.644, polished chrome, with strike 251.60.703.
2) Active leaf: Single door lock assembly.

L. Grommets for Cable Passage through Countertops:
1. Two-inch (51 mm), black, molded plastic grommets and matching plastic caps with slot for wire passage:
a. Product: Subject to compliance with requirements, provide TG series by Doug Mockett & Company, Inc.

M. Trash Grommet Through Countertop: TM1B, six-inch by two-inch (6” x 2”) polished stainless-steel grommet by Doug Mockett and Co., Inc.

N. Exposed Hardware Finishes:
1. For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated:
a. Satin chromium plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

O. Concealed Hardware: Provide finish complying with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire retardant treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot dip galvanized anchors and inserts on inside face of exterior walls and as required for corrosion resistance. Provide toothed steel or lead expansion sleeves for drilled in place anchors.

C. Hanging (Zee Clip) Strips: Extruded aluminum zee type interlocking clips; type, size and quantity for the condition of use.

D. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

E. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

F. Blind Splines: Specialty devices, as required for tight butt joining, types and size as recommended by woodwork fabricator.

G. Covercaps: Where mortises of fastener heads or drawdowns are exposed (blind holes) in finished work, provide black plastic covercaps.

H. Adhesive for Bonding Plastic Laminate:
1. Resorcinol:
a. Adhesive for bonding edges: Hot melt adhesive.

I. Stone Seam Adhesive:
1. Two-part, epoxy resin stone adhesive with an initial set time of not more than two (2) hours at 70 degrees F (21 degrees C), and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Color: Clear.
b. Products: Subject to compliance with requirements, provide Bonstone Materials Corporation - Duproxi or Akemi North America - Akepox.

J. Stone Sealer:
1. Colorless, nonstaining, single component, neutral curing silicone sealant that does not affect color or physical properties of stone surfaces, recommended by stone producer for application indicated. Subject to compliance with requirements, provide products by one of the following:
a. Bostik, Inc.
b. Custom Building Products.
c. Hillyard, Inc.

K. Stone Cleaner: Cleaner specifically formulated for stone types, finishes, and applications indicated, recommended by stone producer and by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

2.5 FABRICATION

A. Woodwork Grade:
1. WI Custom Grade woodwork complying with referenced quality standard:
a. Complete fabrication, including assembly, finishing, and hardware application, before shipment to site to the maximum extent possible. Disassemble components as necessary for shipment and installation. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting. The width of scribe and filler panels shall not exceed 1/2 inch or 1/2-inch clear dimension from adjacent wall to outside face of cabinet door in a 90-degree position, whichever is greater.
b. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify various parts fit as intended and check measurements of assemblies against field measurements indicated on shop drawings before disassembling for shipment.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire retardant treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Corners of cabinets and edges of solid wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
2. Corners of cabinets and edges of solid wood (lumber) members 3/4 inch (19 mm) thick or less: 1-1/2 inch (38 mm).
3. Corners of cabinets and edges of solid wood (lumber) members and rails: 1/16 inch (1.5 mm).

E. Shop cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs:
1. Seal edges of openings in countertops with a coat of varnish.

F. Plastic Laminate Faced Wood Paneling - WS Premium Grade:
1. Plastic laminate - high pressure decorative laminate complying with NEMA LD 3:
   a. Faces: Grade SGF.
   b. Backs: Grade BKH.
   c. Exposed edges: Same as faces.
2. Colors, patterns, and finishes:
   a. Wood grains, matte finish:
      1) Grain direction: Vertical.
3. Panel core - particleboard or medium density fiberboard:
   a. Thickness: 3/4 inch (19 mm).
4. Exposed panel edges:
   a. Applied solid wood banding 11/16 inch (18 mm) thick by depth of panels.
5. Adhesive for bonding edges: Hot melt adhesive or adhesive for faces.
6. Assemble panels by gluing and concealed fastening.

G. Plastic Laminate Cabinets - WS Premium Grade:
1. WI type of cabinet construction: Flush overlay.
2. Materials:
   a. Laminate cladding for exposed surfaces - high pressure decorative laminate:
      1) Horizontal surfaces other than tops: Grade HGS.
      2) Post formed surfaces: Grade HGP.
      3) Vertical surfaces: Grade VGS.
      4) Edges: Grade HGS.
   b. Semi-exposed surfaces:
      1) Surfaces other than drawer bodies - thermoset decorative panels:
         a) Edges of plastic laminate shelves: Grade HGS, matching laminate in color, pattern, and finish.
         b) For semi-exposed backs of panels with exposed plastic laminate surfaces, provide surface of high pressure decorative laminate, Grade VGS.
      2) Drawer sides and backs: Solid hardwood lumber.
      3) Drawer bottoms: Hardwood plywood.
   c. Concealed backs of panels with exposed plastic laminate surfaces: High pressure decorative laminate, Grade BKL.
3. Colors, patterns, and finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces indicated in Finish Schedule.
4. Provide dust panels of 1/4 inch (6.4 mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
5. Fabrication:
   a. Join case body members using concealed dado or dowel methods utilizing glue and pressure. Reinforce dado method with nailing or screws. Mechanical fasteners are not permitted:
      1) Base cabinet bottoms and subtops: Bottoms, 3/4-inch particleboard with low pressure laminate finish on interior side and phenolic backing sheet on concealed side. Subtops, 3/4-inch particleboard with phenolic backing sheet both sides. Fabricate all base cabinets with subtops.
      2) Wall cabinet tops and bottoms: Tops, one-inch (1”) particleboard with low pressure laminate finish on interior side and phenolic backing sheet on concealed side. Bottoms, one-inch (1”) particleboard with manufacturer's low pressure laminate finish both sides.
      3) Cabinet ends: 3/4-inch particleboard with low pressure laminate finish on interior side and phenolic backing sheet on concealed side. Install high pressure plastic laminate on exposed sides of cabinet ends.
      4) Cabinet backs - 1/4-inch hardboard with low pressure laminate finish for standard unexposed backs:
         a) Fabricate with continuous hot melt glue joint between sides, tops,

bottoms, and back on concealed side.
b) Exposed backs: 3/4-inch particleboard with low pressure laminate finish on interior side and high pressure plastic laminate on exterior, exposed side.

5) Cabinet shelves (adjustable, semi-concealed): 3/4-inch particleboard with low pressure laminate finish on both sides. Provide one-inch (1") particleboard for shelves for unsupported spans over 36 inches.
6) Cabinet doors: 3/4-inch particleboard with high pressure plastic laminate on exterior side and heavy gauge balancing sheet on interior side.
7) Drawer fronts: 3/4-inch particleboard with high pressure plastic laminate on exterior side and heavy gauge balancing sheet on interior side.
8) Drawer construction - 1/2-inch solid hardwood back, sides, and subfront; tongued and dadoed into back and subfront, joints glued and pinned; 1/4-inch hardboard bottom tongued and dadoed in all four sides, back, and subfront. Provide additional support with continuous hot melt glue joint on underside of drawers between sides, back, subfront, and bottom:
   a) Reinforce drawer bottoms as required with spreaders.
   b) Apply drawer front to subfront in accordance with manufacturer's standard procedures.
   c) Dividers: 3/4-inch particleboard with manufacturer's low pressure laminate finish on both sides. Secure to inside of cabinet with manufacturer's standard plastic clips.
   d) Dust panels: Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.
   e) Finish exterior exposed surfaces with high pressure plastic laminate. Laminate plastic to particleboard core with balancing sheet using urea resin formaldehyde glue. Fabricate using cold press method with regulated pressure for minimum eight hours at minimum 70 degrees F.

H. Countertops - WI Premium Grade:
1. Solid surface:
   a. Solid surfacing material thickness: 3/4 inch (19 mm).
   b. Colors, patterns, and finishes: Provide materials and products resulting in colors of solid surfacing material indicated on Drawings.
2. Quartz countertops:
   a. Seams:
      1) Fabricate countertops without seams to the extent possible. When seams are necessary, fabricate countertops in sections indicated for joining in field, with sealant filled seams 1/16 inch (1.5 mm) in width.
   b. Fittings: Drill countertops in shop for fittings and similar items.
   c. Fabricate with four-inch (4") backsplashes. Sand minor scratches and stains with #400 then #600 sandpaper.
3. Fabrication:
   a. Fabricate tops in one piece, unless otherwise indicated. Comply with solid surfacing material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing:
      1) Fabricate tops with shop applied edges of materials and configuration indicated.
      2) Fabricate tops with loose backsplashes for field application.
   b. Drill holes in countertops for plumbing fittings and soap dispensers in shop.
4. Countertop construction tolerances:
   a. Variation from plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1,200 mm).
   b. Variation from level: Do not exceed 1/8 inch in 96 inches (3 mm in 2,400 mm), 1/4 inch (6 mm) maximum.

c. Variation in joint width: Do not vary joint thickness more than 1/4 of nominal joint width.
d. Variation in plane at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between planes of adjacent units.
e. Variation in line of edge at joints (lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

2.6 SHELVING

A. Closet and Utility Shelving:
1. Grade: WI Custom.
2. Shelf material: 3/4 inch (19 mm) medium density fiberboard with solid lumber edge.
3. Cleats: 3/4-inch (19 mm) solid lumber.

2.7 SHOP FINISHING

A. Grade: WI Premium grade.

B. Shop finish architectural woodwork at fabrication shop. Defer final touchup, cleaning, and polishing until installation.

C. Produce finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

D. Preparations for Finishing:
1. Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work:
a. Backpriming: Apply one (1) coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two (2) coats to back of paneling and to end grain surfaces. Concealed surfaces of plastic laminate clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

E. Exposed Surfaces - WI Premium Grade:
1. Plastic laminate finish: Use hot plate method for gluing of plastic laminate surfacing materials; glued surfaces shall be in close contact throughout. Glue stains are not permitted.
2. Solid surfacing finish: As scheduled.

F. Unexposed Wood Finish: Water based alkyd type primer/sealer.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements:
1. Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work:

a. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on shop drawings.
b. Established dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

3.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork will be supported and installed as indicated.

3.3 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Before installing architectural woodwork, examine shop fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.4 INSTALLATION

A. Grade: Install woodwork to comply with requirements for grade specified for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2,400 mm). Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

C. Fire Retardant Treated Wood: Handle, store, and install fire retardant treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails (or finishing screws) for exposed fastening, countersunk, and filled flush with woodwork and matching final finish if transparent finish is indicated.

E. Plastic Laminate Paneling:
1. Install paneling to comply with same grade as paneling to be installed:
a. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2,400 mm). Install with no more than 1/16 inch in 96 inches (1.6 mm in 2,400 mm) vertical cup or bow and 1/8 inch in 96 inches (3 mm in 2,400 mm) horizontal variation from a true plane.
b. Anchor paneling to supporting substrate with blind nailing. Do not use face fastening unless covered by trim.

F. Cabinets:
1. Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide

unencumbered operation. Complete installation of hardware and accessory items as indicated:

a. Install cabinets with no more than 1/8 inch in 96 inches (3 mm in 2,400 mm) sag, bow, or variation from a straight line.
b. Maintain veneer sequence matching of cabinets with transparent finish.
c. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer head screws sized for 1 inch (25 mm) penetration into wood framing, blocking, or hanging strips or toggle bolts through metal backing or metal framing behind walls.

G. Countertops:
1. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop:
a. Install countertops with no more than 1/8 inch in 96 inches (93 mm in 2,400 mm) sag, bow, or variation from a straight line.
b. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
c. Caulk space between backsplash and wall with silicone sealant.

H. Solid Surface and Stone Countertop:
1. Install components plumb and level scribed to adjacent finishes. Fabricate with backsplashes. Sand minor scratches and stain:
a. Align adjacent stone and solid surfacing material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
b. Do not cut in field unless otherwise indicated. If countertops or splashes require additional fabrication not specified to be performed at site, return to fabrication shop for adjustment.
c. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
d. Set stone and solid surface materials to comply with requirements indicated on Drawings and shop drawings. Shim and adjust to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and attachments indicated or necessary to secure countertops in place.
e. Where backsplash is indicated, install backsplash and end splash by adhering to wall with water-cleanable epoxy adhesive and to countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
f. Adhesive top mount sinks/bowls to countertops using manufacturer's recommended adhesives and color matched silicone sealants.
g. Keep components clean during installation. Remove adhesives, sealants, and stains. Replace stained components.
h. Apply sealant to joints and gaps; comply with Section 07 92 00: Joint Sealants. Remove temporary shims before applying sealant.
i. Make plumbing connections to sinks in accordance with plumbing requirements.
j. Protect surfaces from damage. Repair work or replace damaged work that cannot be repaired to Architect's satisfaction.

I. Closet and Utility Shelving:
1. Cut shelf cleats at ends of shelves about 1/2 inch (13 mm) less than width of shelves and sand exposed ends smooth:
a. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners maximum 16 inches (400 mm) o.c.
b. Install shelf brackets according to manufacturer's written instructions, spaced

maximum 36 inches (900 mm) o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

c. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners maximum 12 inches (300 mm) o.c.

d. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced maximum 36 inches (900 mm) o.c. and within six inches (150 mm) of end of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

e. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports:
   1) Fasten shelves to cleats with finish nails or trim screws, set flush.
   2) Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

J. Touch up finishing work. Fill nail holes with matching filler where exposed.

K. Construction Tolerances:
1. Variation from plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1,200 mm).
2. Variation from level: Do not exceed 1/8 inch in 96 inches (3 mm in 2,400 mm), 1/4-inch (6 mm) maximum.
3. Variation in joint width: Do not vary joint thickness more than 1/4 of nominal joint width.
4. Variation in plane at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between planes of adjacent units.
5. Variation in line of edge at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between edges of adjacent units, where edge line continues across joint.

3.5 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work.

B. Waste Management:
1. Comply with requirements of Section 01 74 19: Construction Waste Management and Disposal:
   a. Select wood sizes to minimize waste; reuse scrap to the greatest extent possible. Clearly separate scrap for use on site as accessory components, including shims, bracing, and blocking.
   b. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
   c. Prevent saw dust and wood shavings from entering the storm drainage system.
   d. Do not burn scrap lumber that has been pressure treated.
   e. Do not send lumber treated with pentachlorophenol, CCA, or ACA to cogeneration facilities or waste to energy facilities.

3.6 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop applied finishes to restore damaged or soiled areas.

D. Countertops:
   1. Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately:
      a. In-progress cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
      b. Remove and replace countertops that are:
         1) Broken, chipped, stained, or otherwise damaged. Stone may be repaired if methods and results are approved by Architect. Repair solid surface in accordance with manufacturer recommendations when approved by Architect.
         2) Defective countertops.
         3) Defective joints, including misaligned joints.
      c. Replace complying with requirements and showing no evidence of replacement.

E. Stone: Clean stone countertops not less than six (6) days after completion of sealant installation, using clean water and soft rags. Do not use wire brushes, acid type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.

F. Stone Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

3.7 PROTECTION

A. Provide final protection and maintain conditions, acceptable to manufacturer and installer, ensuring woodwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 40 00

SECTION 07 51 00 BUILT-UP BITUMINOUS ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Built-up roofing membrane, conventional application.
2. Insulation, tapered.
3. Base flashings.
4. Roofing cant strips, accessories, roofing vents, and walkways.

B. Related Sections:
1. Section 01 33 00: Submittal Procedures.
2. Section 01 73 29: Cutting and Patching (Project Modernization Only).
3. Section 06 10 00: Rough Carpentry.
4. Section 07 62 00: Sheet Metal Flashing and Trim.
5. Section 07 72 00: Roof Accessories.
6. Section 07 72 33: Roof Hatches. (Where applicable)
7. Section 07 72 36: Smoke Vents. (Where applicable)

C. Reference Standards:
1. ASTM International:
   a. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
   b. ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   c. ASTM D4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
   d. ASTM D5643 Standard Specification for Coal Tar Roof Cement, Asbestos Free.
   e. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials.
2. National Roofing Contractors Association:
   a. NRCA The NRCA Roofing and Waterproofing Manual.
3. Sacramento Metropolitan Air Quality Management District:
   a. SAQMD Rule 904: Air Toxics Control Measures.
4. Underwriters Laboratories Inc.:
   a. UL Fire Resistive Directory.
   b. UL Roofing Materials and Systems Directory (RMSD).

1.3 SUBMITTALS

A. Product Data: Provide data indicating membrane and bitumen materials, base flashing materials, insulation, and surfacing.

B. Certifications:
1. Submit the following certifications indicating:
   a. Built-up bituminous roofing manufacturer’s qualifications specified in this Section.
   b. Built-up bituminous roofing installer’s qualifications specified in this Section.
   c. Materials to be used in manufacturer’s systems compliance with standards

designated. Include certificates of compliance for surface aggregate and materials delivered in hot-bulk equipment.

C. Samples: Only as requested.

D. Installer's Compliance:
1. Submit a written statement from Contractor's installer stating that:
   a. Contract Documents have been reviewed with the primary roofing material manufacturer's representative.
   b. Installer intends to comply with the Contract Documents.
   c. Roofing details do not conflict with manufacturer's product/system warranty.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Design Criteria:
1. Meet requirements of CBC Chapter 15.
2. Meet requirements of Class A roof per CBC Table 1505.1a.
3. Comply with recommendation of NRCA, including any condition not indicated on the Drawings.
4. Prevent water or moisture from penetrating any area of roofing application.
5. Flashings shall not depend solely upon mastic or sealant for primary waterproof protection.
6. Meet requirements of manufacturer's specifications that are consistent with specified built-up bituminous roofing systems and construction conditions
7. Provide built-up roofing system and component materials that have been tested for application and slopes indicated and that are listed by UL for Class external fire exposure and for Factory Mutual Class wind resistance of I-90, in accordance with FM DS 1-28
8. All materials must have been tested by UL as a completed system.
9. Insulation, securement materials, and method of installation shall meet requirements of Factory Mutual Class 1. Listing of material and assembly as Class 1 Roof by Factory Mutual shall constitute proof of compliance with requirements

B. Comply with recommendation of NRCA, including any condition not indicated on the Drawings.

C. Provide products that are free from asbestos and that comply with the applicable provisions of the California Volatile Organic Compound Regulations (VOC).

D. Built-Up Bituminous Roofing Manufacturer: Obtain primary roofing from a single manufacturer. Provide secondary materials as recommended by manufacturer of primary materials.

E. Built-Up Bituminous Roofing Installer's Qualifications:
1. Installer shall be licensed or otherwise certified by manufacturer of accepted roofing system to do work requiring warranty, including materials and workmanship.
2. Installer shall have applied accepted roofing system on two (2) or more projects that have been completed for at least ten (10) years. Information on completed systems shall include date of installation, General Contractor, Owner, contact, and other related information that will facilitate verifications of qualifications.
3. Installer's field supervision: Maintain a full-time supervisor/foreman on jobsite during all phases of bituminous sheet roofing work; at any time roofing work is in progress,

proper supervision of workers shall be maintained. A copy of the specification shall be in the possession of the supervisor/foremen and on the roof at all times.

1.5 WARRANTY

A. Provide five (5) year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Labels: Clearly label materials except gravel with material name, production date or product code, and inspection agency approvals where required.

B. Deliver, store, and handle packaged materials in manufacturer’s original containers with seals unbroken and labels intact until time of use.

C. Unload materials carefully and store off ground, deck, or surface where material could become wet or damp, at temperatures maintained above 50 degrees and below 75 degrees Fahrenheit. Protect from elements. Do not dump onto ground.

D. Keep all moisture sensitive materials dry at all times while being transported, stored, and installed.

E. Store materials on raised pallets. Do not double stack pallets:
   1. Cover top and all sides of moisture sensitive materials and allow for adequate ventilation.
   2. Utilize covers made from breathable materials.

F. Handle materials in a manner to prevent damage. Store rolls in an upright position:
   1. Discard rolls that have been flattened or damaged.
   2. Remove damaged materials from the site and replace with new materials.

G. Avoid concentrated loading of building structure with materials. When storing pallets on the roof, locate over columns.

H. Do not store materials or debris on newly installed roof surfaces.

I. Store liquid materials such as adhesives, thinners, and cleaners in areas away from sparks, open flames, and excessive heat:
   1. No smoking is to be allowed in the area where solvent, adhesives, thinners, or welding agents are being used.
   2. Exercise caution at all times when working with solvent-type materials and comply with the limitations as described by the solvent manufacturer.
   3. Obtain specific approval of Owner’s representative prior to storage of flammable materials on Project site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sheet and Bitumen Materials:
   1. GAF Materials Corporation (bases of design).
   2. Johns Manville Roofing Systems Group.
   3. Or equal.

B. Roof Insulation:
   1. GAF Materials Corporation.
   2. Johns Manville Roofing Systems Group.
   3. Or equal.

2.2 BUILT-UP BITUMINOUS ROOFING SYSTEMS

A. General Requirements:
   1. Materials for built-up roofing systems (BURS) are composed of alternating layers of asphalt ply sheets (built-up bituminous roofing system), except roof insulation board and protection board, shall be products of, or recommended by, a single manufacturer.
   2. Materials quantities stipulated for systems are generalized for BURS; manufacturer may vary to those listed below. Such variations are to be included in product listings and shop drawing review.
   3. Layering built-up roofing may include (refer to Drawing details):
      a. Self-adhered products.
      b. Cold applied.
      c. Hot mopped.

B. System 1 - Typical 4-Ply BURS over plywood roof deck:
   1. Description:
      a. 1/4-inch pressed fiber protection board.
      b. Roof insulation board: Over fiber board over metal roof deck attached with roofing screws and washer per manufacturer's specifications.
      c. Perforated venting base sheet.
      d. First layer: 6-ply asphaltic roofing material.
      e. Second layer: 6-ply asphaltic roofing material.
      f. Third layer: 6-ply asphaltic roofing material.
      g. Top flood coat and gravel.

2.3 COMPONENTS

A. Roof Insulation Boards:
   1. Description:
      a. Closed cell polyisocyranurate core bonded in the foaming process to universal fiberglass reinforced facers.
      b. Meet physical requirements of ASTM C1289, Type II, Class 1, Grade 2.
      c. Thermal resistance and thickness as indicated on drawings/details for roofing systems.
      d. Provide tapered insulation were noted or required to provide the indicated slope.
   2. Product:
      a. Johns Manville Roofing Systems Group's Energy 3, or equal.

B. Felts, Fabrics, and Dry Sheet:
   1. Asphalt base sheet: ASTM D2626.
   2. Fiberglass base sheet: ASTM D4601. GAF Materials Corp's; GAFGLAS #75 Base Sheet, or equal.
   3. Fiberglass roofing felt: ASTM D2178. GAF Materials Corp's GAFGLAS FlexPly 6", or equal.
   4. Mineral surface cap sheet: ASTM D3909. GAF Materials Corp's GAFGLAS Mineral Surfaced Cap Sheet, or equal.

C. Asphalt Primer:
   1. ASTM D41.
   2. Topcoat membrane: Surface applied over concrete.

D. Bitumen:
   1. Asphalt: ASTM D312, type as recommended by built-up bituminous roofing manufacturer for region, climate, and slope of roof.
   2. Bituminous plastic cement: ASTM D4586, Type II, cut back asphalt type.

E. Composition Flashing Systems: All composition flashing systems are to be modified bitumen by same manufacturer as roofing system or built-up bituminous roofing manufacturer's standard.

F. Fabric Reinforcement: Bituminous woven glass fabric meeting requirements of ASTM D1668.

G. Cants: Fiberboard, minimum three-inch (3") vertical leg, four inches (4") wherever possible, 45-degree slope.

H. Surfacing Aggregate: Clean, hard, durable river aggregate conforming to ASTM D1863, gradation size No. 7, and as recommended by built-up bituminous roofing system manufacturer.

I. Fasteners:
   1. Mechanical fasteners for insulation: Meet insulation manufacturer's requirements.
   2. Concrete: Twin legged fastener, electro zinc plated, fastener to provide positive attachment and resistance to specified wind up-lift forces. Minimum depth per manufactures recommendations (1.8 inches long with 2.7-inch diameter plate).
   3. Base sheet to wood nailers: One-inch (1") square head nails in length as required to fully penetrate into substrate.

J. Traffic Surfacing:
   1. Description: 3/4-inch thick panels manufactured from asphalt, reinforcing fibers, and mineral granules, thoroughly ground and molded under heat, and compressed between tops and bottoms of inert fiberglass membranes with skid-resistant mineral granules applied to top surface; color as selected from manufacturer's standard range. Refer to Drawings for location and layout.

K. Other Accessories: As recommends by built-up bituminous roofing manufacturer.

PART 3 EXECUTION

3.1 SITE CONDITIONS

A. Environmental Requirements:
   1. Proceed with roofing work when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.
   2. Do not apply roofing membrane during unsuitable weather.
   3. Do not apply built-up bituminous roofing when ambient temperature is below 40 degrees Fahrenheit or above 95 degrees Fahrenheit.
   4. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring; apply built-up bituminous roofing in dry weather.

3.2 EXAMINATION

A. Examine areas to receive built-up bituminous roofing and verify that:
   1. Surfaces and site conditions are ready to receive work.

2. Deck is supported and secure.
3. Deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped, and suitable for installation of roof system.
4. Voids in substrate have been patched flush with surrounding surfaces.
5. Nailing strips, blocking, reglets, other embedded items, and items to penetrate surfaces have been installed in proper locations.
6. Low spots or areas where ponding water may occur have been adequately corrected.
7. Roof openings, curbs, and penetrations through roof are solidly set and cant strips are in place.
8. New flashings and other related items have been installed or fabricated and are onsite ready for installation when roofing work commences.
9. Conditions are otherwise satisfactory for application.

B. Assure that related work of other trades has been completed, and that the sequence of the flashing work may proceed in accordance with good flashing practice and the intent of the Specifications.

C. Notify District's representative immediately in writing of any discrepancy between field conditions and the ability to achieve the intent of these Specifications, and do not proceed with the work until adequate correction has been made.

D. Do not start work until unsatisfactory conditions have been corrected. Start of work shall signify acceptance of, and responsibility for, condition of receiving surface.

3.3 PREPARATION

A. Protection:
1. Protect surrounding work from damage by roofing materials or operations; especially protect paving and building walls adjacent to hoists and kettles.
2. Prevent bitumen, aggregate, and debris from entering and clogging roof drains and rainwater conductors.
3. Protect existing fresh air intakes, doors, and windows as required to prevent entry of asphalt fumes.
4. Be responsible for costs of repair or restoration of other work damaged by materials or operations of built-up bituminous roofing

B. Clean roof and flashing areas thoroughly of loose materials and foreign matter to provide sound, dry, and level decks for positive attachment of roof system materials.

3.4 GENERAL APPLICATION REQUIREMENTS

A. Apply built-up bituminous roofing and related work in accordance with materials manufacturer's specifications for systems accepted for this Project and meeting requirements of CBC Chapter 15, except where other requirements are indicated or specified (Chapter 15 for roofing and 1511 reroofing).

B. Make attachments to metal work and accessories integral with waterproofing in accordance with accepted built-up bituminous roofing manufacturer's recommendations.

C. Bitumen:
1. Do not exceed temperature limitation recommend by roofing materials manufacturer for heating bitumen:
   a. Bitumen shall be applied at its equiviscous temperature (EVT) for the method of application being used, plus or minus 25 degrees Fahrenheit.
   b. Do not exceed the flash point.

c. Do not exceed the finishing blowing temperature.
2. Provide clearly visible thermometer on each kettle or delivery truck used to heat bitumen.
3. Remove overheated bitumen from site immediately.
4. Do not apply hot bitumen under conditions that would cause foaming.

D. Lay multiple-ply courses of felt and hot bitumen in shingle plies, and comply with recommendations of roofing material manufacturer:
1. Lap felts with direction of drainage.
2. Start installation of plies at lowest point of roof with plies perpendicular to slope of roof deck.
3. Except where spot mopping sheets, lay felt plies in bitumen while still hot and tacky and broom thoroughly for full felt width to eliminate trapped air or gases.
4. Lay out roof areas accurately for proper lap and sequence of plies.
5. Lay out plies accurately and broom each into hot, tacky bitumen.
6. Ensure felts are free from fishmouths, buckles, blisters, and other faulty workmanship.
7. Built-up bituminous roofing displaying voids will be rejected.
8. Do not use wet, once wet, or damaged rolls.

E. Provide cant strips where indicated, where required, and wherever feasible to prevent 90-degree bending of membrane system. Turn all membranes up on cant trip where they abut against vertical surface.

F. Provide membrane base flashings at cant strips and other sloping and vertical surfaces, at roof edges, and at major penetrations through roof deck. Nail or provide other forms of mechanical anchorage of membrane flashing to vertical surfaces as recommended by roofing material manufacturer.

G. Valley and Ridge Lines: Reinforce with one additional ply layer, centered on-line, set on top of the top membrane ply in full 25 pound per 100 square foot mopping of hot asphalt.

H. Provide any other roofing accessories necessary to conform to built-up roofing manufacturer’s requirements.

3.5 ROOF INSULATION

A. Install where required by built-up bituminous roofing systems.

B. Verify proper thickness, locations, and attachment of insulation stops.

C. Lay boards with edges in moderate contact without forcing.

D. Cut roof insulation boards to fit neatly around vertical surfaces and deck projections.

E. Joint Tape: Tape joints in top layer of insulation according to manufacturer’s instructions. Apply joint tape to joints between wood blocking or insulation stops and insulation boards.

F. Do not leave installed roof insulation boards exposed to weather.

G. Meet requirements of materials manufacturers.

H. Tapered Insulation at Crickets:
1. Apply multi-layers of tapered insulation in pattern to achieve positive slope of 1/8 inch per foot. Slope to drains.

2. Stagger the joints of each layer from the preceding course by 1/2 of the board's dimension. Set boards into 30 pounds of asphalt. Bring boards into moderate uniform contact at sides and ends while asphalt is hot and fluid. Install top layer with joints continuous in both directions.

I. Cant Strips:
1. Install at intersection of vertical surfaces and where otherwise required.
2. Install into hot asphalt to top of insulation.
3. Mechanically fasten into nailers with square head roofing nails at 12 inches on center, minimum three (3) nails per piece. Use nails with sufficient length to achieve minimum 1-1/2-inch penetration into nailers.
4. Miter corners for tight fit.

J. Tapered Edging: Install wherever necessary to achieve smooth transitions for the roof membrane. Do not allow transitions greater than 1/4 inch.

K. Water Cut-Offs: Provide at exposed edges of roof insulation boards at end of day's work and whenever rain is imminent. Extend cut-offs six inches (6") on roof deck, carry up and over roof insulation boards, and extend six inches (6") on top of built-up roofing. Remove before continuing installation of roof insulation boards.

3.6 BUILT-UP BITUMINOUS ROOFING INSTALLATION

A. Complete application of built-up bituminous roofing daily up to line of termination at end of day's work. Daily aggregate surfacing is not necessary.

B. Apply fiberglass roofing felts in a solid, continuous asphalt moping:
1. Lay plies straight and flat.
2. Apply all ply sheets so they are properly shingled to flow of water.
3. Provide enough overlap so that every cross section will have required number of plies.
4. Stagger all end laps at least 12 inches.
5. Install one (1) extra ply sheet, 36 inches wide, at all waterways.

C. Ensure full and continuous seal and contact between asphalt and ply sheets or base sheet, including ends, edges, and laps by applying asphalt uniformly and by brooming fully before asphalt cools:
1. Use minimum 34-inch wide brooms or squeegees.
2. Do not walk on membrane until asphalt cools down.
3. Keep equipment off hot membrane.

D. Do not allow sheets to contact other sheets even at roof edges or over cants and tapered edge strips:
1. Cut out fishmouths or side laps not completely sealed with asphalt, and patch with ply sheet set in hot asphalt.
2. Remove and replace all sheets that are fully and continuously bonded or that have inadequate mopping along end or edge laps.

E. At Roof Edges and Openings: Provide bleed sheets (felt envelopes) to prevent bitumen drippage.

F. Roof Sumps and Drains:
1. Temporarily plug drains to prevent asphalt drippage; remove at end of each work day.
2. Install tapered insulation to form a minimum 24-inch by 24-inch sump area.
3. Bring roofing felt plies down over insulation and extend into roof drain flashing ring.
4. Over felts in sump, apply modified bitumen flashing to extend minimum four inches (4")

out of sump onto main roof deck and into roof drain flashing ring.
5. Verify installation of gravel stops at outer edge of sump.
6. Coordinate to embed gravel stop in plastic cement over flashing with flange stripped in with flashing.
7. Embed aggregate surfacing in plastic cement on top of flange and stripping for six inches (6") from raised lip of gravel stop.

G. Turn all membranes up on cant trip where they abut against vertical surface.

H. Provide membrane base flashings at cant strips and other sloping and vertical surfaces, at roof edges, and at major penetrations through roof deck. Nail or provide other forms of mechanical anchorage of membrane flashing to vertical surfaces as recommended by roofing material manufacturer.

I. Composition Flashing:
1. Install in accordance with manufacturer's recommendations and requirements specified.
2. Provide at termination of roofing on curbs, vertical surfaces, and where indicated or required for complete watertight installation.
3. Verify proper locations of nailers at top of flashing.
4. Prime vertical and horizontal substrate surfaces to be flashed with asphaltic products with asphalt primer and allow to dry before applying flashing.
5. Strip Flashing:
   a. Refer to Section 07 62 00: Sheet Metal Flashing and Trim and other related Sections for flashing and similar work. Coordinate to provide a complete watertight and weatherproof roofing system:
      1) Prime all flanges (both sides) with asphalt primer and allow to dry.
      2) Set flanges in 1/8-inch thick continuous bed of plastic roofing cement.
      3) Fasten flange as detailed.
      4) Apply two (2) strip flashing sheets into 1/8-inch thick continuous bed of flashing cement extending four inches (4") and six inches (6") respectively onto completed roof membrane.
6. Base Flashing:
   a. Apply over cants and run up parapet walls where indicated on the Drawings (maximum 24 inches above roof line).
      1) Apply base sheet and modified bitumen built-up base flashing system consisting of a minimum of a base sheet, a ply sheet, and polymer modified top sheet.
      2) Mechanically fasten base sheet at 12 inches on center in rows eight inches (8") apart.
      3) Apply ply sheet over base sheet in a continuous 1/8-inch thick layer of flashing cement.
      4) Apply modified bitumen base flashing over ply sheet in a continuous 1/8-inch thick layer of flashing cement.
      5) Fasten top edge at six inches (6") on center.
      6) Do not seal top edge of base flashing.

J. Sheet Metal:
1. Supervise installation of sheet metal items integral with built-up bituminous roofing and ensure conformity with built-up bituminous roofing manufacturer's recommendations.
2. Metal flashings that are an integral part of roofing shall be installed simultaneously with roofing application.

3.7 SURFACING

A. Do not install surfacing until the inspection of the membrane has been performed and "punch list" repairs have been completed.

B. Cap Sheet:
1. Assure roof surface is clean, free of dust, dirt, or moisture. Light priming is required if contamination of surface or oxidation has occurred.
2. Applied cap sheet to be free of buckles, wrinkles, blisters, fishmouths, or voids.
3. Apply cap sheet over and parallel to the roofing plies and lapped so that the flow of water is over or parallel to, but never against the laps.
4. Pre-cut cap sheet into 12-foot maximum lengths and allow to relax.
5. Starting at the low point, install cap sheet surfacing over the entire roof field surface, extending above the cant strip two inches (2") into a continuous mopping of hot asphalt applied at a nominal rate of 25 pounds per 100 square feet.
6. Place tension on the ends of cap sheet lengths as they are flopped into place so that the sheet lays flat in the asphalt and adheres.
7. Install cap sheet with two-inch (2") side laps and six-inch (6") end laps.
8. Stagger end laps not less than three feet (3') apart.
9. Brooming-in may be necessary to ensure bond between asphalt and sheet.
10. Sprinkle mineral granules in exposed asphalt along edges and ends of mineral cap sheets.

3.8 TRAFFIC SURFACING INSTALLATION

A. Sweep areas to receive traffic surfacing clean of dust, sand, and gravel prior to installation.

B. Apply mineral surfaced cap sheet surfacing over completed roof membrane at areas indicated on Drawings:
1. Cut mineral surfaced cap sheet into 18-foot lengths and allow to relax one (1) hour.
2. Set in continuous mopping of 25 pounds per square foot of hot asphalt.
3. Install one (1) ply of mineral surfaced cap sheet extending one foot (1') beyond sides of panels.
4. Lap ends six inches (6") and laps sides 12 inches. Stagger end joints.
5. Apply mineral surfaced cap sheet after strip flashing has been applied, but prior to base flashing application.

C. Install traffic surfacing panels over mineral surfaced cap sheet with plastic roofing cement in accordance with manufacturer's recommendations. Space panels six inches (6") apart, unless indicated otherwise, to permit unrestricted flow of roof water. Lay out panels so that end pieces are not less than 1/2 full length.

D. Install aggregate over mineral cap sheet and up to edge of panels.

3.9 FIELD QUALITY CONTROL

A. See Section 01 40 00: Quality Requirements.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the work.

3.10 CLEANING

A. Remove bituminous markings from adjacent finished surfaces.

B. Repair or replace defaced or disfigured finishes caused by work of this Section.

C. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

D. At completion of the work of this Section, remove all excess materials, cartons, wrappings, and tools and implements from the site.

3.11 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials. Provide special protection or avoid heavy traffic on completed work when ambient temperature is above 80 degrees Fahrenheit.

END OF SECTION 07 51 00

SECTION 07 62 00 SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. It is the intent of this Section that the work shall:
   1. Conform to all applicable DSA and building code requirements.
   2. Include all shop and field formed sheet metal work shown on Drawings, specified, or required, including, but not limited to:
      a. Roof penetration sleeves, collars, hood, and umbrella counterflashing.
      b. Metal counterflashing.
      c. Expansion joint.
      d. Metal perimeter edge.
      e. Gutters, downspouts, splash blocks and splash pans.
      f. One-way roof moisture relief vents.
      g. Metal gravity vents.
      h. Metal heat exhaust vents.
      i. Sanitary vent pipes.
      j. Pipe box.
      k. Copings, trim, and miscellaneous sheet metal accessories.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 07 72 00: Roof Accessories.
   3. Section 07 92 00: Joint Sealants.
   4. Division 22: Plumbing.
   5. Division 23: Heating, Ventilating & Air Conditioning (HVAC).

C. Reference Standards:
   1. ASTM International (ASTM):
      a. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
      b. B32 Standard Specification for Solder Metal.
      c. C1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   2. National Association of Architectural Metal Manufacturers (NAAMM).
   3. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.
   4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Shop Drawings: Indicating sizes, configurations, and details of attachment to related and

adjacent work, materials, and finishes.

C. Samples:
1. Full range of finish colors for Architect's selection.
2. 12-inch long sample of each specified item with approved finish.
3. Provide full size mockup of all shop built assemblies.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Fabricator and installer of roof related flashing and accessories shall be the same as the membrane roof installer.

B. Comply with governing codes and regulations of authorities having jurisdiction.

C. Installation Conference:
1. Refer to Section 01 31 00: Project Management and Coordination.

1.5 WARRANTY

A. Manufacturer's Product Warranty:
1. Manufacturer's standard 20-year Kynar 500 or Hylar 5000 finish warranty signed by the manufacturer, with guarantee covering any failure of the fluoropolymer finish during the warranty period.
2. Failure is defined to include, but is not limited to, deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
3. Correction may include repair or replacement of failed product.

B. Roofing Contractor’s Warranty:
1. Contractor shall warrant the sheet metal work and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight, for a period of five (5) years from date of Substantial Completion.
2. Defects shall include, but not be limited to:
a. Leaking water or bitumen within building or construction.
b. Becoming loose from substrate.
c. Loose or missing parts.
d. Finish failure as defined above.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Handle and store materials and equipment in such a manner as to avoid damage.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers named within specification are approved for use on the Project providing:
1. Their products meet or exceed the specifications.
2. Company has a minimum of five (5) years’ experience manufacturing products of the type specified.

3. Products have been tested in conjunction with roofing membrane system as an assembly and as such has obtained the same approval and rating as the roofing membrane system.
4. Products are approved for use by the roofing membrane manufacturer.

B. Substitutions shall be in accordance with Division 01 requirements regarding substitutions.

2.2 SHEET METAL MATERIALS

A. General Requirements: Roofing sheet metal system shall have been tested in conjunction with roofing membrane system as an assembly and have the same approval and rating as the roofing membrane system.

B. Prefinished Aluminum Sheet:
1. Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209.
2. Finish: Kynar 500, color as selected by Architect from manufacturer's standard colors.
3. Thickness: Minimum 0.040 inch, except as otherwise indicated.

C. Sheet Lead: Four (4) pound minimum for use at roof drains and soil stacks.

D. Stainless Steel: Type 302/304 Soft Temper, No. 2D finish. Minimum thickness 24 gauge, except as otherwise noted.

2.3 FASTENERS

A. Same metal as flashing/sheet metal or other noncorrosive metal or as noted below.

B. Exposed fasteners shall be self-sealing and gasketed for weathertight installation (ZAC type).

C. Match finish of exposed heads with material being fastened.

D. Mechanical Fasteners:
1. Nails: Stainless steel ring shank, minimum 1-1/2 inch in length with 1/2-inch diameter head.
2. Washers: Steel washers with bonded rubber sealing gasket.
3. Screws: Self-tapping sheet metal type of stainless steel or compatible with material being fastened, with hooded integral EPDM washers (ZAC type).
4. Rivets: Stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.

E. Clips: Continuous cleat (coping/fascia). Minimum 20-gauge, G-90 galvanized, stainless steel, or aluminum. Match material of coping/fascia and provide one (1) gauge heavier.

2.4 RELATED MATERIALS

A. Solder: ASTM B32, alloy grade 58, 50 percent tin, 50 percent lead.

B. Flux:
1. Phosphoric acid type, manufacturer’s standard:
   a. For use with steel or copper: Rosin flux.
   b. For use with stainless steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Underlayment:

1. 48 mil minimum, non-reinforced, homogeneous, waterproof, impermeable elastomeric sheeting manufactured by Nervastral, Inc. or Lexus Co.

D. Adhesives: Type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and watertightness.

E. Metal Accessories: Sheet metal clips, straps, anchoring devices, clamps, and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, and size and gauge recommended by installer to suit application and performance.

F. Sealant:
1. Type A:
   a. Type: One-part, non-sag, moisture-curing polyurethane sealant.
   b. Approved products/manufacturers:
      1) Chem-Calk 900, manufactured by Bostik Construction Products Division.
      2) Vulkem 921, manufactured by Mameco International, Inc.
      3) Dynatrol I, manufactured by Pecora Corporation.
      4) NP 1, manufactured by Sonneborn Building Products.
      5) Approved equal.
2. Type B:
   a. Type: One-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
   b. Approved products/manufacturers:
      1) Chem-Calk 1200, manufactured by Bostik Construction Products Division.
      2) 795 Silicone Building Sealant, manufactured by Dow Corning Corporation.
      3) 895 Silicone, manufactured by Pecora Corporation.
      4) Omniseal, manufactured by Sonneborn Building Products
      5) Spectrem 2, manufactured by Tremco Incorporated.
      6) Approved equal.

G. Grout - Pitch Pans:
1. Type: Quick-setting, non-shrink, non-metallic, high strength formula complying with ASTM C1107.
2. Approved products/manufacturers:
   a. Sure Grip High Performance Grout, manufactured by Dayton Superior Corporation.
   b. Premier Quick-Trim, manufactured by L & M Construction Chemicals, Inc.
   c. Masterflow, manufactured by Master Builders, Inc.
   d. Sonnogrout 10K, manufactured by Sonneborn Building Products.
   e. Approved equal.

H. Pitch Pan Filler:
1. Type: Pourable polyurethane sealer, approved by roofing system manufacturer.
2. Approved products/manufacturers:
   a. Quick Pitch Sealer, manufactured by U.S. Intec.
   b. SPM Pourable Sealer, manufactured by Johns Manville.
   c. Approved equal.

I. Termination Bar:
1. Material: Extruded aluminum bar with flat profile.
2. Size: 1/8-inch thick by one-inch (1”) wide with factory punched 1/4-inch by 3/8-inch oval holes spaced six inches (6”) on center.
3. Approved product/manufacturer:
   a. TB 125, manufactured by TruFast Corp.
   b. Approved equal.

J. Pipe Hangers and Supports: Refer to Section 07 72 00: Roof Accessories.

K. Splash Blocks: Concrete type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five percent (5%) air entrainment. Use at locations where roof drainage dumps on ground.

L. Splash Pans: 22-gauge stainless steel, of size and profiles indicated. Use at locations where roof drainage discharges over adjoining, lower roof level(s).

M. One-Way Moisture Relief Vents: Shall be fabricated from spun aluminum as recommended by roofing manufacturer.

2.5 FABRICATION

A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers, and counterflashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.

B. Comply with manufacturer's installation instructions and recommendations.

C. Unless noted otherwise, fabricate perimeter edge/fascia, scuppers, gutters, downspouts, copings, counterflashings, wind clips, and trim from pre-finished aluminum sheet steel.

D. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edges, counterflashing, and coping caps of equal length – minimum two-foot (2’) lengths.

E. Fabricate items to size and dimensions as indicated on the Drawings. Limit single-piece lengths to ten feet (10’).

F. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage, or deterioration of the work.

G. Integrate flashing in a manner consistent with detailing. Form work to fit substrates.

H. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.

I. Fabricate items with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.

J. Fold back edges on concealed side of exposed edge to form hem.

K. Unless noted otherwise, lap joints minimum one inch (1”). Rivet and solder joints on parts that are to be permanently and rigidly assembled.

L. Seams:
1. Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
2. Pre-finished galvanized steel: Seal pre-finished metal seams with rivets and silicone sealant.
3. Metal other than aluminum: Tin edges to be seamed, form seams, and solder.

M. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand metal flanges prior to applying any primers. Prime all metal in contact with bituminous material.

N. Back-paint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

O. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one-inch (1") deep filled with mastic sealant concealed within joints.

2.6 FABRICATED ITEMS

A. Metal Flashings (Minimum ten-foot [10'] lengths):
1. Through wall receiver tray: Minimum 24-gauge stainless steel, through wall receivers shall not extend past the face of the exterior veneer more than 3/4 inch.
2. Counterflashing: Minimum 24-gauge stainless steel.

B. Wind Clips: Minimum 24-gauge stainless steel (or match material of counterflashing), one-inch (1") wide by length to engage counterflashing a minimum of 1/2 inch. To be installed at all wall flashings and at curb flashing lengths longer than five feet (5').

C. Roof Penetrations:
1. Umbrella counterflashing: Two-piece construction of minimum 24-gauge stainless steel, fabricated in accordance with Drawings or Project requirements.
2. Pitch pans:
   a. 24-gauge stainless steel.
   b. Fabricate to provide installed minimum clear inside perimeter dimension of two inches (2") on each side of penetrating element.
   c. Fabricate pans to at least six inches (6") above the finished roof membrane and with 1/4-inch hem at top edge and with four-inch (4") flanges. Round all corners of flange.
   d. Fabricate metal bonnets for all pans, no exceptions. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from 1/4-inch steel plate. Draw band bonnets fabricated from 22-gauge stainless steel may be used on circular projections.

D. Metal Edge:
1. Minimum 0.040-inch thick pre-finished aluminum formed in maximum ten-foot (10') lengths, with six-inch (6") wide cover plates of same profile, four-inch (4") flange, maximum seven-inch (7") fascia, 3/4-inch gravel stop.
2. Provide expansion slip joints at maximum 20 feet on center.
3. Shop fabricate all interior and exterior corners. Fabricate exterior corners with 18-inch minimum to four-foot (4') maximum legs. Lap, rivet, and seal prior to delivery to jobsite.
4. Fabricate to sizes and dimensions as indicated on Drawings with a minimum one-inch (1") coverage past top of wall. Refer to SMACNA Fig. 2-5A.
5. Provide mock-up for Architect's approval prior to fabrication.

E. Continuous Cleats: Continuous strips, same material and profile, minimum one (1) gauge heavier of item to which cleats attach.

F. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24-gauge stainless steel, or as shown or directed otherwise.

G. Angle Termination Bar: Aluminum pressure bar 1/8 inch by one inch (1”).

H. Vent Pipe Flashing: Four (4) pound lead. Provide proper size to fold down inside of pipe a minimum of one inch (1”).

I. Roof Drain Flashing: Four (4) pound lead, minimum 30 inches by 30 inches.

J. Coping:
1. Minimum 0.040-inch thick pre-finished aluminum, with six-inch (6”) wide cover plates of same profile.
2. Fabricate as outlined in SMACNA; Refer to Figure 3-4 A.
3. Provide tapered substrate to slope to one (1) side, and cover with waterproof membrane.
4. Install with continuous cleat one (1) side and fasten other side.

K. Gutters/Downspouts/Collector Heads:
1. Gutters and downspouts: Minimum 0.040-inch thick pre-finished aluminum formed in maximum ten-foot (10’) lengths, with six-inch (6”) wide cover plates. Minimum five-inch by six-inch (5” x 6”) box gutter (verify size meets rainfall data per SMACNA).
2. Gutter/downspout straps: Minimum 0.040-inch thick pre-finished (match color) aluminum. Hem both sides.
3. Gutter supports: Minimum 0.040-inch thick pre-finished (match color) aluminum hemmed around 1/8-inch galvanized bent steel bracket.
4. Gutter screen: Stainless steel 1/4-inch diamond wire screen enclosed in a pre-finished frame.
5. Collector heads: Minimum 0.040-inch thick pre-finished (match color) aluminum. As outlined in SMACNA; Refer to Figure 1-25F and Figure 1-28 with alternate Section A-A.

L. Pipe Box Cover: 24-gauge stainless steel.

M. Heat Exhaust Curbs and Hoods: 22-gauge stainless steel.

N. Expansion Joint Cover: Minimum 24-gauge stainless steel (provide pre-finished metal at perimeter edge end termination.)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

B. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set in place.

C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.

D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

A. Field measure site conditions prior to fabrication work.

B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4-inch hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction, elevation, or plane and at intersections. Locate field joints not less than 12 inches, nor more than three feet (3') from actual corner. Laps shall be one inch (1"), riveted and soldered at following locations:
   1. Pre-fabricated corners.
   2. Transitions.
   3. Changes in direction, elevation, and plane.
   4. At intersections.

B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible; and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight and weatherproof.

C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.

D. Separations: Provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation at locations of contact as recommended by manufacturer or fabricator. Do not use materials that are incompatible with roofing system.

E. Continuous Cleat: At exposed edges of perimeter edge, fascias, cap flashings, and where required, attach continuous cleat at six inches (6") on center with appropriate fasteners.

F. Gravel Guard/Fascia:
   1. Install with expansion joints ten feet (10') o.c., 1/2-inch expansion leeway, with cover plate.
   2. Set in asphalt mastic and fasten into nailer at three inches (3") o.c. staggered.
   3. Buff sand Kynar surface of flange and prime.
   4. Strip in flange with specified stripping plies set in hot bitumen extending three inches (3") from outer edge of flange to at least three inches (3") inward towards gravel stop. Provide finish stripping ply of modified bitumen base ply in hot bitumen extending six inches (6") from the outer edge of the flange and butt base of gravel stop.

G. Counterflashing:
   1. Do not use surface mount counterflashing except as noted in Drawings.
   2. Set in through wall with receiver and spring lock counterflashing, as detailed in Drawings and to NRCA roofing manual, SMACNA standards.
   3. Coordinate installation of through-wall flashing with the masonry contractor.
   4. Seal through-wall in conjunction with masonry wall waterproofing.
   5. Install wind clips 30 inches o.c. at all counterflashing over five feet (5') in length.

H. Pitch Pans, Metal Flanges:
   1. Apply mastic under pitch pan or metal flashing flange at least 1/2 pound per linear foot.
   2. Prime all metal flanges with asphalt primer prior to flashing installation.
   3. Clean all projections enclosed in pitch pans in any manner suitable and coated with a rust inhibitive coating as approved by the Architect. Coating shall be allowed to dry prior to pitch pan fill.
   4. Fill base of pitch pans with grout or cementitious binder and allow to cure.
   5. Top Finish Fill: Self-leveling, one-part urethane; at least two inches (2") to top of pitch

pan sides.

6. Strip in pitch pan flanges with two (2) strips of specified stripping plies set in hot bitumen extending three inches (3”) from the outer edge of the flange to at least three inches (3”) inward toward base of pitch pan. Provide finish stripping ply of SBS modified bitumen membrane in hot bitumen extending six inches (6”) from the outer edge of the flange and butt to base of pitch pan.

I. Sanitary Vent Stacks:
   1. Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.
   2. Fold lead sleeve down inside of pipe a minimum of one inch (1”). Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.

J. Roof Drains:
   1. After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement at specified locations.
   2. Extend lead flashing into drain bowl or pipe a minimum of two inches (2”) and over top of piping/bowl connection, if possible. Apply a continuous bead of specified Type A sealant, at intersection of pipe and drain bowl.
   3. If drain bowl and pipe connection is contaminated with bituminous material, strip-in area with three-coursing of plastic roof cement and fabric.
   4. Prime top of lead flashing sheet to receive strip-in membrane.

K. Gutters/Downspouts:
   1. Install gutters as detailed.
   2. Install downspouts plumb and level and attached to columns or wall with straps located at top and bottom of downspout and maximum ten feet (10’) on center.
   3. Install splash pad or block under discharge port of downspouts. Install splash pan over a protection (walkway) pad for downspouts located at roof level.
   4. End caps, downspout outlets, gutter and downspout straps, support brackets, and joint fasteners to be manufactured to suit profile and dimension of gutter and downspout.
   5. Install all anchoring devices as outlined in SMACNA.
   6. Expansion joints: Lap or butt type per SMACNA, locate every 50 linear feet.

L. Expansion Joint:
   1. Construct wood curbs as shown on Drawings and as outlined in the NRCA and SMACNA manuals.
   2. Install underlayment, form envelope, and secure underlayment to curb. Fill envelope with compressible insulation.
   3. Securely fasten expansion joint cover to curb with grommetted fasteners spaced six inches (6”) on center.
   4. Taper expansion joint down at the metal edge.

M. Coping:
   1. Install wood nailers as shown on Drawings.
   2. Install metal cleats with appropriate fasteners spaced six inches (6”) on center.
   3. Install underlayment over the wood substrate. Lap ends minimum of six inches (6”) and secure membrane in place. Seal laps with appropriate adhesive.
   4. Install metal coping allowing 1/2-inch spaces between segments. Lock coping onto cleat and install appropriate fasteners through the interior fascia spaced 24 inches on center in enlarged holes.
   5. Install cover plate centered over coping joint in continuous beads of specified Type B sealant, placed approximately one inch (1”) from cover edges. Refer to SMACNA for alternate joints as required by length.
   6. Install appropriate fastener through neoprene washer and cover plate between coping segments.

7. Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joint a minimum of four inches (4”). Fasten cover plate on one (1) side of joint only (provide wall flashing membrane up and over parapet wall in accordance with manufacturer’s detail).

3.4 CLEANING AND PROTECTION

A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.

B. Remove scraps and debris and leave work area clean.

C. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.

D. Prime soldered area of phosphatized metal after cleaning to prevent rusting.

E. Paint metal flashings that have been soiled with bitumen with aluminized paint.

F. Clean other work damaged or soiled by work of this Section.

G. Protect finished work from damage.

END OF SECTION 07 62 00

SECTION 07 72 00 ROOF ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Roof curbs.
   2. Equipment supports.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 06 10 00: Rough Carpentry.
   3. Section 07 62 00: Sheet Metal Flashing and Trim.

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings:
   1. Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
      a. Size and location of roof accessories specified in this Section.
      b. Method of attaching roof accessories to roof or building structure.
      c. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Warranty: Provide manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's Architectural Sheet Metal Manual details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

B. Mockups: Refer to Section 07 62 00: Sheet Metal Flashing and Trim.

C. All work must conform to California Building Code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M, G90 (Z275) coated.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 (AZM150) coated.

C. Aluminum Sheet: ASTM B209, alloy and temper recommended by manufacturer for type of use and mill finish.

D. Aluminum Extrusions and Tubes: ASTM B221, alloy and temper recommended by manufacturer for type of use, mill finished.

E. Stainless-Steel Shapes or Sheet: ASTM A240/A240M or ASTM A666, Type 304 or Type 316, No. 2D finish.

F. Steel Shapes: ASTM A36/A36M, hot-dip galvanized to comply with ASTM A123/A123M, unless otherwise indicated.

G. Steel Tube: ASTM A500, round tube, baked-enamel finished.

H. Galvanized Steel Tube: ASTM A500, round tube, hot-dip galvanized to comply with ASTM A123/A123M.

I. Galvanized Steel Pipe: ASTM A53/A53M.

2.3 MISCELLANEOUS MATERIALS

A. Glass-Fiber Board Insulation: ASTM C726, one inch (25 mm) thick.

B. Polyisocyanurate Board Insulation: ASTM C1289, one inch (25 mm) thick.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, not less than 1-1/2 inch (38 mm) thick.

D. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

I. Roofing Cement: ASTM D4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.4 ROOF CURBS

A. Roof Curbs:
1. Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with an integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or shop drawings of equipment to be supported:
   a. Manufacturers (Butler IF Curb):
      1) Colony Custom Curbs.
      2) Commodity Products Company, Inc.
      3) Conn-Fab Sales, Inc.
      4) Curbs Plus Inc.
      5) Custom Curb, Inc.
      6) LM Curbs.
      7) Loren Cook Company.
      8) Metallic Products Corporation.
      9) Pate Company (The).
      10) Roof Products & Systems Corporation.
      11) Roof Products, Inc.
      12) Thaler Metal Industries Ltd.
      13) ThyCurb; Div. of Thybar Corporation.
      14) Uni-Curb, Inc.
      15) Vent Products Company, Inc.
   b. Material: Galvanized or aluminum-zinc alloy-coated steel sheet, 0.052 inch (1.32 mm) thick.
   c. Liner: Same material as curb, of manufacturer's standard thickness and finish.
   d. Factory install wood nailers at tops of curbs.
   e. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   f. Factory insulate curbs with manufacturer’s standard rigid or semi-rigid insulation:
      1) Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 16 inches (400 mm), unless otherwise indicated.
      2) Sloping roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.5 EQUIPMENT SUPPORTS

A. Equipment Supports:
1. Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with an integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or shop drawings of equipment to be supported:
   a. Manufacturers:
      1) Colony Custom Curbs.

2) Commodity Products Company, Inc.
3) Conn-Fab Sales, Inc.
4) Curbs Plus Inc.
5) Custom Curb, Inc.
6) LM Curbs.
7) Loren Cook Company.
8) Metallic Products Corporation.
9) Pate Company (The).
10) Roof Products & Systems Corporation.
11) Roof Products, Inc.
12) Thaler Metal Industries Ltd.
13) ThyCurb; Div. of Thybar Corporation.
14) Uni-Curb, Inc.
15) Vent Products Company, Inc.

b. Indicate load requirements on Drawings or insert below.
c. Material: Galvanized or aluminum-zinc alloy-coated steel sheet, 0.052 inch (1.32 mm) thick.
d. Factory install continuous wood nailers 3-1/2 inches (90 mm) wide at tops of equipment supports.
e. Metal counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
f. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
g. Equipment support height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer.
h. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
i. Sloping roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on shop drawings.

3.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

3.3 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, to verify actual locations, dimensions, and other conditions affecting performance of work:
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, is securely anchored, and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection:
   1. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer:
      a. Coat concealed side of uncoated aluminum and stainless steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
      b. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
      c. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation: Set roof curb so top surface of roof curb is level.

F. Equipment Support Installation: Set equipment support so top surface of equipment support is level.

G. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.5 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 09 90 00: Painting and Coating.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.6 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07 72 00

SECTION 07 72 33 ROOF HATCHES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Includes:
1. Provide factory-fabricated roof hatches for ladder access.
2. Provide factory-fabricated fixed hatch railing system.
3. Provide factory-fabricated ladder safety posts.

B. Related Sections:
1. Section 05 50 00: Metal Fabrications.
2. Section 06 10 00: Rough Carpentry.
3. Section 07 62 00: Sheet Metal Flashing and Trim.
4. Section 07 72 00: Roof Accessories.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data.

B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer: A minimum of five (5) years’ experience manufacturing similar products.

B. Installer: A minimum of two (2) years’ experience installing similar products.

C. Manufacturer’s Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.5 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s standard warranty. Materials shall be free of defects in material and workmanship for a period of five (5) years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer’s original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier’s freight bill of lading.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer:
   1. The BILCO Company, New Haven, CT.
   2. Milcor, Grand Rapids, MI.
   3. Approved equal.

2.2 ROOF HATCH

A. Basis of Design: Bilco Type S-50.

B. Furnish and install where indicated on plans metal roof hatch Type S, size width: 36 inches (914mm) by length: 30 inches (762mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

C. Performance Characteristics:
   1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m^2) with a maximum deflection of 1/150th of the span and a 140 psf (684 kg/m^2) wind uplift for aluminum (Type S-50) roof hatches.
   2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
   3. Operation of the cover shall not be affected by temperature.
   4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

D. Cover: Shall be 11-gauge (2.3mm) aluminum with a three-inch (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

E. Cover Insulation: Shall be fiberglass of one-inch (25mm) thickness, fully covered and protected by a metal liner 18-gauge (1mm) aluminum.

F. Curb: Shall be 12 inches (305mm) in height and of 11-gauge (2.3mm) aluminum. The curb shall be formed with a 3-1/2-inch (89mm) flange with 7/16-inch (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, six inches (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

G. Curb Insulation: Shall be rigid, high-density fiberboard of one-inch (25mm) thickness on outside of curb.

H. Lifting Mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe for aluminum construction, welded to the curb assembly.

I. Hardware:
   1. Heavy pintle hinges shall be provided.
   2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
   3. Roof hatch shall be equipped with interior and exterior padlock hasps.

4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a one-inch (25mm) diameter red vinyl grip handle to permit easy release for closing.
6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

J. Finishes: Factory finish shall be mill finish aluminum.

K. Accessories:
1. At each roof hatch provide the following:
   a. Hatch Rail System.
   b. Ladder Safety Post.

2.3 HATCH RAIL SYSTEM

A. Furnish and install where indicated on plans hatch rail system Model RL2-S. The hatch rail system shall be field assembled and installed per the manufacturer's instructions.

B. Performance Characteristics:
1. High visibility safety yellow powder coat paint finish.
2. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two (2).
4. Corrosion resistant construction with a five (5) year warranty.
5. Hinged gate shall ensure continuous barrier around the roof hatch.
6. Self-closing gate hinge and positive latching system provided with hatch rail system.

C. Posts and Rails: 1-1/4-inch (32mm) 6061 T6 schedule 40 aluminum pipe.

D. Hardware: Mounting brackets shall be 3/8-inch (9mm) thick extruded aluminum. Pivoting post guides with compression fittings and latching mechanism shall be cast aluminum. Self-closing hinges and all fasteners shall be type 316 stainless steel.

2.4 LADDER SAFETY POST

A. Furnish and install where indicated on plans ladder safety post Model LU-1. The ladder safety post shall be pre-assembled from the manufacturer.

B. Performance Characteristics:
1. Tubular post shall lock automatically when fully extended.
2. Safety post shall have controlled upward and downward movement.
3. Release lever shall disengage the post to allow it to be returned to its lowered position.
4. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14 inches (356mm) on center and clamp brackets to accommodate ladder rungs up to 1-3/4 inch (44mm) in diameter.

C. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.

D. Material of Construction: Steel.

E. Balancing Spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.

F. Hardware: All mounting hardware shall be Type 316 stainless steel.

G. Finishes: Factory finish shall be yellow powder coat steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work:
   1. Test units for proper function and adjust until proper operation is achieved.
   2. Repair finishes damaged during installation.
   3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer that will not damage finish.

END OF SECTION 07 72 33

SECTION 07 72 36 SMOKE VENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Provide factory-fabricated double-leaf automatic smoke vents.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 06 10 00: Rough Carpentry.
   3. Section 07 62 00: Sheet Metal Flashing and Trim.
   4. Section 07 72 00: Roof Accessories.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data.

B. Shop Drawings: Submit shop drawings including profiles, accessories, location, fusible links, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer: A minimum of five (5) years’ experience manufacturing similar products.

B. Installer: A minimum of two (2) years’ experience installing similar products.

C. Manufacturer’s Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.5 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s standard warranty. Materials shall be free of defects in material and workmanship for a period of five (5) years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer’s original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier’s freight bill of lading.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: Type DSH Automatic Roof Smoke Vent by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.bilco.com.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate unit level, plumb, and in proper alignment with adjacent work:
   1. Test units for proper function and adjust until proper operation is achieved.
   2. Test fusible link and install replacement fusible link after testing.
   3. Repair finishes damaged during installation.
   4. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer that will not damage finish.

END OF SECTION 07 72 36

SECTION 07 92 00 JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Control and expansion joints on exposed interior and exterior surfaces.
   2. Perimeter joints between wall surfaces and frames of interior and exterior doors and openings.
   3. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   4. Joints indicated or as necessary.
   5. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 03 30 00: Cast-In-Place Concrete
   2. Section 05 50 00: Metal Fabrications.
   3. Section 08 11 13: Hollow Metal Doors and Frames.
   4. Section 08 14 16: Flush Wood Doors.
   5. Section 09 90 00: Painting and Coating.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data for each joint sealant product. Data to indicate elasticity and durability of each joint sealant product. Submit written certification from manufacturers of sealants attesting products are suitable for use indicated, verified through in-house testing laboratory:
      a. Written certification from manufacturers of joint sealants attesting that products comply with specification requirements and suitable for use indicated verified through manufacturers testing laboratory within the past 36 months or since most recent reformulation, whichever is most recent:
         1) Complete instructions for handling, storage, mixing, priming, installation, curing, and protection of each type of sealant.
         2) Manufacturer's letter, clearly indicating proposed lot numbers of each sealant supplied and expiration date sequence.
   2. Recycled Content:
      a. Indicate recycled content; indicate percentage of pre-consumer and postconsumer recycled content per unit of product.
      b. Indicate relative dollar value of recycled content product to total dollar value of product included in Project.
      c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
      d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
   3. Local/regional materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the Project site.
      b. Manufacturing location(s): Indicate location of manufacturing facility; indicate

distance between manufacturing facility and the Project site.
c. Product value: Indicate dollar value of product containing local/regional materials; include materials cost only.
d. Product component(s) value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

4. VOC data: Submit manufacturer's product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
5. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

B. Samples:
1. Provide color samples from full manufacturer's full range for each type of sealant specified for Architect's review.

C. Certificates and Reports:
1. Product Certificates: Manufacturer's product certificate for each kind of joint sealant and accessory.
2. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
3. Product test reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
4. Preconstruction compatibility and adhesion test reports:
a. From sealant manufacturer, indicating the following:
1) Materials forming joint substrates and sealant backings have been tested for compatibility and adhesion with sealants.
2) Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
5. Preconstruction field adhesion test reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified.
6. Field adhesion test reports: For each sealant application tested.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
1. Firm having minimum five (5) years' documented experience and specializes in the installation of sealants:
a. Exposed sealant work (sealants used for air and weatherseals external at perimeter, metal panel to panel joints) shall be performed by a single (i.e. one) firm specializing in the installation of sealants who has successfully produced work comparable to Project.
b. Concealed sealant work (sealants that are internal to skylights and providing an air seal) shall be the responsibility of the subcontractor providing erection of the respective system.

B. Source Limitations: Obtain each type of joint sealant from a single manufacturer.

C. Product Testing:
1. Test joint sealants using a qualified testing agency:
a. Testing agency qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
b. Test according to SWRI Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion in peel, and indentation hardness.

D. Environmental Requirements:
   1. Toxicity/IEQ:
      a. Comply with applicable regulations regarding toxic and hazardous materials:
         1) VOC content of interior sealants - sealants and sealant primers complying with limits for VOC content for SCAQMD when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
            a) Sealants: 250 g/L.
            b) Sealant primers for nonporous substrates: 250 g/L.
            c) Sealant primers for porous substrates: 775 g/L.
      b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

1.5 WARRANTY

A. Written warranty, signed by installer agreeing to repair or replace elastomeric joint sealant work that has failed to provide a weathertight system within specified warranty period:
   1. Warranty period: Five (5) years from date of Substantial Completion.

B. Written warranties (weatherseal and stain resistance), signed by sealant manufacturer agreeing to furnish joint sealants to repair or replace those that fail to provide airtight and watertight joints, or fail in adhesion, cohesion, abrasion resistance, stain resistance, weather resistance, durability, or appear to deteriorate in manner not specified in the manufacturer's data as an inherent quality of the material within specified warranty period:
   1. Warranty period: Five (5) years from date of Substantial Completion.

C. Warranties specified exclude deterioration or failure of sealants from:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer’s written instructions to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backings, and related materials compatible with one another and with joint substrates under conditions of service and application, as stated by sealant manufacturer’s published data, and as substantiated by the manufacturer for each application through testing.

B. Liquid Applied Sealants: Comply with ASTM C920 and requirements indicated for each

liquid applied sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain Test Response Characteristics: For sealants in contact with porous substrates, provide nonstaining products that have undergone testing according to ASTM C1248 and do not stain porous joint substrates.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors: For fully concealed joints, provide standard color of sealant that has the best overall performance characteristics for the application shown. For exposed joints, submit color samples to Architect for approval, from manufacturer's full line of standard colors.

F. Manufacturer's Representative: Use sealant produced by manufacturer who agrees to send a qualified technical representative to site upon request for the purpose of rendering advice concerning the recommended installation of manufacturer's materials.

G. Sealants: Self-leveling compounds for horizontal joints in pavements and non-sag compounds elsewhere except as shown or specified.

H. Silicone Sealant:
1. Comply with ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O:
   a. Use: Typical joints between masonry, metals, glass, and plastics (two-part silicone sealants).
   b. Properties:
      1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum pli value after seven (7) day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion and Peel.
      2) Cure system and oil content: Neutral cure system specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
   c. Product and manufacturer: Dow Corning; 756 Silicone Building Sealant - HP with Additive.

I. Silicone Sealant:
1. ASTM C920, Type S, Grade NS, Class 50, for Use NT:
   a. Use: Typical joints between masonry, metals, glass, and plastics (single component sealants).
   b. Properties:
      1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates.
      2) Cure system and oil content: Neutral cure system specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
   c. Product and manufacturer:
      1) BASF Building Systems; Omniseal 50.
      2) Dow Corning Corporation; 756 SMS, 791, 795, 995 as applicable.
      3) GE Advanced Materials, Silicones; SilGlaze II SCS2800, SilPruf NB SCS9000, SilPruf SCS2000, or UltraPruf II SCS2900 as applicable.
      4) Pecora Corporation, as applicable.
      5) Sika Corporation, Construction Products Division; SikaSil-C995.
      6) Tremco, as applicable.
      7) Comparable product.

J. Polyurethane Sealants:
   1. ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O:
      a. Use: Typical Wall and floor joints (two-part polyurethane sealants). Use at concrete joints.
      b. Properties:
         1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates.
      c. Products and manufacturers:
         1) BASF Building Systems; Sonolastic NP-2.
         2) Pecora Corporation; Dynatred.
         3) Sika Corporation, Construction Products Division; Sikaflex 2c NS or Sikaflex 2c NS TG as applicable.
         4) Tremco, as applicable.
         5) Comparable product.

K. Two-Part Polyurethane Sealants:
   1. ASTM C920, Type M, Grade NS, Class 50; use NT, M, A and O:
      a. Use: Typical Wall and floor joints (two-part polyurethane sealants).
      b. Properties:
         1) Performance: Non-stain, non-bleed, non-streaking to sealed and adjacent substrates. The minimum pli value after seven (7) day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion in Peel.
      c. Products and manufacturers:
         1) BASF Construction Chemicals; NP 2.
         2) Pecora Corporation, as applicable.
         3) Schnee-Morehead, Inc.; Permathane SM 7200.
         4) Sika Corporation, Inc.; Sikaflex - 2c NS TG.
         5) Tremco, as applicable.
         6) Comparable product.

L. Mildew Resistant Silicone Sealant:
   1. ASTM C920, Type S, Grade NS, Class 25, Use NT, Substrate uses G, A, and O; and containing fungicide for mildew resistance; acid curing:
      a. Use: One-part mildew-resistant silicone, formulated with fungicide for sealing interior joints of nonporous substrates around ceramic tile, plumbing fixtures, and showers.
      b. Products - provide one of the following:
         1) BASF Building Systems; Omniplus.
         2) Dow Corning; 786 Mildew Resistant Silicone Sealant.
         3) GE Silicones; Sanitary SCS 1700.
         4) Pecora Corporation, as applicable.
         5) Sika Corporation, Inc., as applicable.
         6) Tremco, as applicable.
         7) Comparable product.

M. Latex Sealant:
   1. Non-elastomeric, one-part, non-sag, paintable latex sealant that is recommended for exposed applications on the interior. Complying with ASTM C834, Type OP (opaque sealants):
      a. Products are subject to compliance with requirements; provide one of the following:
         1) BASF; Sonolastic Sonolac.
         2) Pecora Corporation; AC-20 + Silicone.
         3) Sika Corporation, Inc., as applicable.
         4) Tremco, as applicable.
         5) Comparable product.

N. Acoustical Joint Sealant:
   1. Non-sag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
      a. Products are subject to compliance with requirements; provide one of the following:
         1) BASF, as applicable.
         2) Pecora Corporation; AC-20 FTR or AIS-919.
         3) Sika Corporation, Inc., as applicable.
         4) Tremco, as applicable.
         5) USG Corporation; SHEETROCK Acoustical Sealant.
         6) Comparable product.

O. Sealant Backing:
   1. Provide sealant backings that are non-staining, compatible with joint substrates, sealants, primers, and joint fillers, and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing:
      a. Cylindrical sealant backings: Preformed, compressible, resilient, non-staining, non-waxing, non-extruding backings of flexible plastic foam complying with ASTM C1330, and of type indicated below. Select shape and density of cylindrical sealant backings in consultation with the manufacturer for proper performance in specific condition of use in each case.
      b. Type C - closed cell polyethylene foam material with surface skin, nonabsorbent to liquid water and gas, non-outgassing in unruptured state; provide one of the following:
         1) BASF, as applicable.
         2) HBR Closed Cell Backer Rod; Nomaco, Inc.
         3) Pecora Corporation, as applicable.
         4) Sonolastic Closed-Cell Backer-Rod; BASF Construction Chemicals.
         5) Tremco, as applicable.
         6) Comparable product.

P. Window Glazing:
   1. Product Description: Ready to use glazing compound that may be used for face glazing wood or metal sash on existing windows. It is a knife-grade consistency allows for smooth, easy applications. Stick tightly to glass and sash and resists sagging, shrinking and cracking. Follow manufacturers suggested uses.
   2. This product is NOT to be used on plastic windowpanes, porcelainized steel insulating panels or any insulated glass units with organic seals, stained or leaded glass. Any window pain over 48 inches in any direction.
   3. Listed manufacturer:
      a. Dap 33 Glazing compound.
      b. Approved equal.

Q. Miscellaneous Materials:
   1. Primer: Material recommended, as verified through compatibility and adhesion testing, by joint sealant manufacturer for the substrates indicated to be sealed.
   2. Cleaners for nonporous surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants with joint substrates.
   3. Masking tape: Non-staining, non-absorbent material compatible with joint sealants and that will not stain nor mar the finish of surface adjacent to joints to which it is applied.
   4. Cork joint filler: Resilient and non-extruding, ASTM D1752, Type II.
   5. Bond breaker tape: Polyethylene, TFE fluorocarbon, or plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler

materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Do not proceed with installation of joint sealants under the following conditions:
      a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F (4.4 degrees C).
      b. When joint substrates are wet. Should joints or backing materials become wet, remove and replace backing material with new.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

3.2 EXAMINATION

A. Examine joints indicated to receive joint sealants for compliance with requirements for joint configuration, installation tolerances, and conditions affecting sealant performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Surface Cleaning of Joints:
   1. Clean out joints immediately before installing joint sealants to comply with the recommendations of joint sealant manufacturer and requirements:
      a. Remove foreign material from joint substrates interfering with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, oil, grease, water, surface dirt, and frost.
      b. Clean concrete, masonry, unglazed surfaces of tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil free compressed air.
      c. Remove laitance and form-release agents from concrete.
      d. Clean metal, glass, porcelain enamel, glazed surfaces of tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming (Elastomeric Sealants Only): Prime joint substrates where recommended in writing by joint sealant manufacturer, based on prior testing and experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.4 INSTALLATION

A. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants applicable to materials, applications, and conditions indicated.

C. Sealant Backings:
   1. Install sealant backings to support sealants during application and at position necessary to produce cross sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability:
      a. Do not leave gaps between ends of sealant backings. Trim for tight fit around obstructions or elements penetrating the joint.
      b. Do not stretch, twist, puncture, or tear sealant backings.
      c. Remove absorbent sealant backings that become wet before sealant application and replace with dry sealant backings.
      d. Install bond breaker tape behind sealants where backings are not used between sealants and back of joints.

D. Weeps and Vents: Install weeps and vents into joints at the same time sealants are being installed. Locate weeps and vents spaced recommended by sealant manufacturer and the window and curtain wall fabricator and erector. Do not install weeps and vents at outside building corners. Do not install vents at horizontal joints immediately below shelf angles, sills, and through wall flashings.

E. Sealants:
   1. Install sealants by proven techniques resulting in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at same time sealant backings are installed:
      a. Apply sealants in depth in accordance with manufacturer's recommendations and recommended general proportions and limitations.
      b. Apply elastomeric sealants, in joints not subject to traffic or abrasion, to a depth equal to 50 percent of the joint width, but not less than 1/4 inch (6 mm) and not more than 1/2 inch (13 mm).
      c. Apply non-elastomeric sealants to a depth approximately equal to the joint width.

F. Tooling of Non-Sag Sealants:
   1. Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform, beads to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces. Tool exposed surfaces of sealants to the profile shown, or if none is shown, tool slightly concave:
      a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
      b. Provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.
      c. Against rough surfaces or in joints of uneven widths avoid the appearance of excess sealant or compound by locating the compound or sealant well back into joint wherever possible.

G. Installation of Preformed Silicone Sealant System:
   1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.

2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

I. Acoustical Sealant Installation: At sound rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer written recommendations.

3.5 FIELD QUALITY CONTROL

A. Field Adhesion Testing:
1. Field test exterior wall joint sealant adhesion to joint substrates:
   a. Extent of testing - test completed and cured sealant joints:
      1) Perform ten (10) tests for the first 1,000 feet (300 m) of joint length for each kind of sealant and joint substrate.
      2) Perform one (1) test for each 1,000 feet (300 m) of joint length thereafter or one (1) test per each floor per elevation.
2. Test method: Test joint sealants according to Method A, Field Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer field adhesion hand pull test criteria.
4. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure original sealant surfaces are clean and new sealant contacts original sealant.

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

indicated requirements.

3.6 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work. Coordinate interior application of sealants with interior finishes schedule.

3.7 CLEANING AND PROTECTION

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

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

END OF SECTION 07 92 00

Project Manual

For

Schroeder Elementary School
HVAC Upgrade & Modernization

15151 Columbia Ln. Huntington Beach, CA 92647

VOLUME 1 and 2

Bidding and Contract Requirements
And
Specifications

for the

Westminster School District
14121 Cedarwood St. Westminter, CA 92683

Date:

PBK Project No.: 250376

Package

Project Manual

for:

Schroeder Elementary School
HVAC Upgrade & Modernization

for the

Westminster School District

Date:

PBK Project No.: 250376

Package

Consultants:

Architect:
PBK
2400 East Katella
Suite 950
Anaheim, CA 92806
Phone: (949) 548-5000

Structural:
VCA Engineers Inc.
631 S. Atlantic Blvd.
Monterey park, CA 91754

Phone: (323) 729-6098

Civil:
FPL and Associates
30 Corporate Park,
Suite 401
Irvine, CA 92606
Phone: (949) 252-1688

Electrical:
LEAF Engineers
8163 Rochester Ave.
Suite 100
Rancho Cucamonga, CA 91730
Phone: (909) 390-3111

Mechanical:
LEAF Engineers
8163 Rochester Ave.
Suite 100
Rancho Cucamonga, CA 91730
Phone: (909) 390-3111

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCULENTS

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

1.2 SUMMARY

A. Provide items shown on the Drawings and specified, including, but not limited to the following:
   1. Standard and fire rated steel doors.
   2. Steel frames for doors, sidelites, transoms, and windows.
   3. Louvers and vision lites in steel doors, if shown or required.
   4. Sound rated steel doors.
   5. Thermally rated steel doors.

B. Related Sections:
   1. Section 07 92 00: Joint Sealants.
   2. Section 09 21 16: Gypsum Board Assemblies.
   3. Section 09 24 00: Cement Plastering.
   4. Section 09 90 00: Painting and Coating.

C. Reference Standards:
   1. ASTM International (ASTM)
      a. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
      c. A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      d. A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      e. C1363 Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
      f. E283 Standard Test Method for Determining the rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
      g. E413 Standard Classification for Rating Sound Insulation.
   2. Hollow Metal Manufacturers Association (HMMA):
      a. HMMA 802 Manufacturing of Hollow Metal Doors and Frames.
      b. HMMA 810 Hollow Metal Doors.
      c. HMMA 830 Hardware Preparation and Locations for Hollow Metal Doors and Frames.
      d. HMMA 840 Installation and Storage of Hollow Metal Doors and Frames.
      e. HMMA 850 Fire Rated Hollow Metal Doors & Frames.
      f. HMMA 890 Technical Summary of Hollow Metal by HMMA.
   3. National Fire Protection Association (NFPA):
      a. 80 Fire Doors and Fire Windows.
      b. 252 Fire Tests of Door Assemblies.
   4. Steel Door Institute – Current Standards: Technical Data Series.

5. Underwriters Laboratories Inc. (UL):
   a. Building Materials Directory.
   b. Listing and Labeling.
   c. 10B and 10C Fire Tests of Door Assemblies.
   d. 1784 Air Leakage Tests of Door Assemblies.
6. Intertek Testing, Services (Warnock Hersey, Inc. (WHI): Listing and Labeling.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's standard details and catalog data demonstrating compliance with specifications and referenced standards.
   2. Manufacturer's installation instructions.

B. Shop Drawings:
   1. Indicate complete schedule in detail for each steel door and frame using the same reference number for details and openings as those on the contract Drawings. If any door is not by the steel door manufacturer, only the door opening number should be shown along with the type of door (wood, plastic laminate faced, etc.):
      a. Show details of construction, installation, connections, anchors, hardware reinforcement, hardware preparation, louvers, and floor and threshold clearances.

C. Samples are required from non-Steel Door Institute members:
   1. 12-inch by 12-inch sample of a fire-rated and non-rated door, cut from corner of door, showing door construction.
   2. 12-inch by 12-inch sample of each type of door louver specified or required, showing louver construction.
   3. Six-inch (6”) long sample of a fire-rated, non-rated frame, and each type of glass stop specified or required, showing corner and construction.

D. Certificates: Manufacturer’s certification that oversized openings are in compliance with specifications.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: If other than a manufacturer listed under Paragraph 2.1 is proposed for use on the Project, it shall be a company specializing in the manufacturer of steel doors and frames of the type specified for this Project with a minimum of five (5) years’ experience.

B. All steel doors and frames shall be by a single manufacturer, shop drawings to be submitted with manufacturer’s insignia, which is being supplied.

C. Furnish steel doors and frames to meet current ANSI/Steel Door Standards.

D. ANSI A250.13 Testing and Rating of Sever Windstorm Resistant Components for Swing Door Assemblies.

E. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

F. Comply with ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

G. Regulatory Requirements:
   1. Fire-Rated Assemblies:
      a. Fire-rated door, panel, frame, and fire window construction shall conform to NFPA 252, or UL 10B, as applicable, and acceptable to the code of authorities having jurisdiction.
      b. Fire-rated door construction:
         1) Notwithstanding any other requirements of this Section, provide gauge of metal, method of construction, hardware preparation, reinforcement, and placement, glass opening size, and other specifics required to obtain the specified or required label. The label shall contain the fire resistance rating (20-minute, 45-minute, 1-hour, 1-1/2-hour, 3-hour, etc.) and the designation (A, B, C, D, or E); doors with B Label shall be 1-1/2 hour.
         2) Fire-rated doors used in a stairway enclosure, shall be so constructed so that the maximum transmitted temperature shall not exceed 450 degrees F above ambient temperature at the end of 30 minutes of the Standard Fire Exposure Test and shall be so noted on the label.
      c. Fire-rated openings:
         1) Conform to NFPA 80 for fire-rated class shown or required by code of authorities having jurisdiction:
            a) Units shall be identical to assemblies whose fire resistance characteristics have been determined in accordance with requirements specified above, and shall be labeled and listed by UL, WHI, or other inspection and testing agency acceptable to the code of authorities having jurisdiction.
            b) Fire-rated steel doors, panels, frames, and fire windows shall bear permanent labels attesting to fire resistance. At stairway enclosures, provide units listed for 450 degree F maximum temperature rise rating for 30 minutes of exposure.
            c) Oversized openings shall be constructed in accordance with all applicable requirements for labeled door construction.
            d) Fire rated door assemblies with gaps in excess of 1/8 inch between door and frame will not comply with NFPA 80.
            e) Locate label on hinge side of doors and frames so that when door is closed, label is not visible.
            f) Caution shall be taken to ensure that labels are not removed, damaged, or painted over.
            g) Glass panes shall not exceed sizes allowed whether indicated or not on the Drawings.

H. Wind Loads: Provide hollow metal and door hardware assemblies approved by DSA, including anchorage, capable of withstanding wind load design pressures that are calculated for this Project by a registered Architect or Engineer and is part of the construction documents per CBC.

I. Accessibility Requirements:
   1. Comply with applicable requirements:
      a. Americans with Disability Act of 1990, as amended: 2010 ADA Standards.
      b. 2022 California Building Code (CBC). CCR Title 24, Part 2, as adopted and amended by DSA.

J. Pre-Installation Conference: Refer to Section 01 31 00: Project Management and Coordination.

1.5 WARRANTY

A. Warrant the work specified herein for one (1) year against becoming unserviceable or

causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.

B. Defects shall include, but not be limited to:
   1. Use of incorrect materials in opening.
   2. Incorrect labeled components installed within opening.
   3. Noisy, rough, or difficult operation.
   4. Failure to meet specified quality assurance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in accordance with manufacturer's instructions, and as follows:
   1. In manufacturer's original, clearly labeled, undamaged containers or wrappers.
   2. Containers or wrappers shall list the name of the manufacturer and product.

B. Deliver materials to allow for minimum storage time at the Project site. Coordinate delivery with the scheduled time of installation.

C. Protect products from moisture, construction traffic, and damage:
   1. Store under cover in a clean, dry place, protected from weather and abuse.
   2. Store in a manner that will prevent rust or damage.
   3. Store doors in a vertical position, spaced with blocking to permit air circulation.
   4. Do not use non-vented plastic or canvas shelters.
   5. Should containers or wrappers become wet, remove immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed below whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must comply with Manufacturer Qualifications, must manufacture equivalent products to those specified, and comply with requirements of Section 01 25 00: Substitution Procedures and Form, regarding substitutions to be considered:
   1. CECO Door Products, Brentwood, TN; (615) 661-5030.
   2. Curries Company, Mason City, IA; (515) 423-1334.
   3. Pioneer Industries, Inc., Kewanee, IL; (309) 856-6000.
   4. Republic Builders Products Company, McKenzie, TN; (800) 733-3667.
   5. Steelcraft Mfg. Co., Cincinnati, OH; (513) 745-6400.
   6. Stiles Co.
   7. Approved equal.

2.2 MATERIALS, GENERAL

A. Steel requirements, all frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM A1008 general requirements. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM A1011. Exterior frames and interior frames where shown on approved Drawings or required in damp, moist, humid, and wet areas, i.e., toilets, locker rooms, showers, etc., to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel and galvannealed to A-60 minimum coating weight standard per ASTM A653 and A924, with coating weight of not less than 0.60 ounce per square foot (0.30 ounce per square foot per side).

2.3 FRAME FABRICATION

A. Minimum Gauges:
   1. Interior openings:
      a. Less than four feet (4') width: 16 gauge.
      b. Four feet (4') in width and greater: 14 gauge.
   2. Exterior openings: 14 gauge

B. Design and Construction:
   1. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings. Hinge jambs that butt adjacent 100-degree walls shall have at least four-inch (4") wide frame face to assure the door trim will not strike the wall prior to the door opening at least 100 degrees. Frame profile shall match wall thickness where practical, i.e., 4-3/4-inch at four-inch (4") CMU, 6-3/4-inch at six-inch (6") CMU, and 8-3/4-inch at eight-inch (8") CMU. At masonry wall openings, fabricate frames to suite masonry opening with two-inch (2") head member.
   2. Frames shall be strong and rigid, neat in appearance, square, true, and free of defects, warp, and buckle. Molded members shall be clean cut, straight, and of uniform profile throughout their length.
   3. Jamb depths, trim, profile, and backbends shall be as shown on approved shop drawings.
   4. Corner joints, including face and inside corners, shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted. Face of frame shall be ground smooth. Knockdown (KD) frames are not permitted.
   5. Minimum depth of stops shall be 5/8 inch, except at fire windows where minimum depth of stops shall be 3/4 inch.
   6. Frames for multiple openings shall have mullion and rail members that are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Mullions shall be key locked removable type. Keys shall be master keyed to Owner's Best system.
   7. High frequency hinge reinforcement: Provide high frequency hinge reinforcements at door openings 48-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
   8. Continuous hinge reinforcement: Provide welded continuous 12-gage strap for continuous hinges specified in hardware sets in Division 08 Openings.
   9. Provide countersunk flat or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at exterior locations.
   10. Provide A60 galvannealed coating at frames in restrooms and locker rooms with showers/Jacuzzi, clean areas such as kitchen rooms.
   11. Electrical knock out boxes:
      a. Factory weld 18-gage electrical knock out boxes to frame for electrical hardware preps; included but not limited to electric thru wire hinges, electrical raceways, door position switches, electric strikes, jamb mount card readers, and magnetic licks as noted in door hardware sets in Division 08 Openings:
         1) Electrical knock out boxes are required at door position switches, electric strikes, card readers, and middle hinge locations.
         2) Provide electrical knock out boxes with 3/4-inch knockouts.
         3) Conduit to be coordinated and installed in field from middle hinge box and strike box to door position box.
         4) Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Openings.
         5) Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
         6) Provide field installed conduit per Division 28: Electronic Safety & Security Section for standardized plug connectors to accommodate up to twelve (12)

wires as required for electrified door hardware specified in hardware sets in Division 08 Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.

12. Hardware reinforcements:
    a. Frames shall be mortised, reinforced, drilled, and tapped at factory for fully template mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
    b. Minimum thickness of hardware reinforcing plates shall be as follows:
        1) Hinge and pivot reinforcements (1-1/4-inch x 10-inch minimum size): Seven (7) gauge.
        2) Strike reinforcements: 12-gauge stiffeners.
        3) Flush bolt reinforcements: 12-gauge.
        4) Closer reinforcements: 12-gauge.
        5) Reinforcements for surface-mounted hardware, hold-open arms, and surface panic devices: 12-gauge.
13. Floor anchors: Minimum 14-gauge, securely welded inside each jamb, with holes for floor anchorage.
14. Jamb anchors:
    a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-strap type. Anchors shall be not less than 16-gauge steel. The number of anchors provided at each jamb shall be as follows:
        1) Frames up to seven-feet-six-inches (7’-6”) in height: Three (3) anchors.
        2) Frames seven-feet-six-inches (7’-6”) to eight feet (8’) in height: Four (4) anchors.
        3) Frames over eight feet (8’) in height: One (1) anchor for each two feet (2’) or fraction thereof in height.
    b. Frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16-gauge thickness, securely welded inside each jamb as follows:
        1) Frames up to seven feet six inches (7’-6”) in height: Four (4) anchors.
        2) Frames seven feet six inches (7’-6”) to eight feet (8’) in height: Five (5) anchors.
        3) Frames over eight feet (8’) in height: Four (4) anchors plus one (1) additional for each two feet (2’) or fraction thereof over eight feet (8’).
    c. Frames to be anchored to previously placed concrete, masonry, or structural steel shall be provided with anchors of suitable design as shown on approved shop drawings.
15. Dust cover boxes: Shall be of not less than 26-gauge steel and shall be provided at all mortised hardware items. Eight-inch (8”) CMU walls with face brick shall have dual offset jamb anchors.
16. Steel spreader: Shall be provided on all frames, temporarily attached to bottoms of both jambs for bracing during shipping and handling.
17. Loose glazing stops: Shall be of cold rolled steel, not less than 20 gauge, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws. Loose stops at exterior frames shall be placed on the interior side of the frames.
18. Unless otherwise noted on Drawings, ALL doors coat inside of frame profile with corrosion resistant coating to minimum thickness of 1/16 inch.

C. Frame Color: Field painted under Section 09 90 00: Painting and Coating to match face of door unless otherwise indicated on drawings.

2.4 DOOR FABRICATION

A. Minimum Gauges
   1. Interior doors: 0.047 inch or 18 gauge (16 gauge for high frequency doors).Exterior doors: 0.059 inch or 16 gauge (14 gauge for windstorm rated doors).Design and Construction:
   2. Types: Doors shall be custom fabricated, of types and sizes shown on approved shop drawings, and shall be seamless face construction with no visible seams or joints on vertical edges with fully welded seams free from blemishes and defects. Thickness shall be 1-3/4 inch, unless specifically noted or shown otherwise. Exterior doors: Provide doors with 22-gage steel z-channels placed at six inches (6”) apart with foamed in place polyurethane core, with a thermal insulation calculated R factor of 11.01 per ASTM C518 Standards.
   3. Fabrication:
      a. Doors shall be strong, rigid, and neat in appearance, free from warpage and buckle.
      b. Corner bends shall be true and straight and of minimum radius for gage of metal used.
      c. Provide stiffeners with polystyrene core spaced maximum six inches (6”) on center and extending full height of door.
      d. Fill interior with noncombustible fiberglass insulation. Use mineral board filler as required for labeled doors.
      e. Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled, and dressed smooth to provide a smooth flush surface.
      f. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot weld to both faces. Exterior doors shall have an additional flush closing channel at top and bottom edges. Openings shall be provided in the bottom closure channel at top and bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.
      g. Continuous hinge reinforcement: Provide welded continuous 12-gage strap for continuous hinges specified in hardware sets in Division 08: Openings.
      h. Electrical raceways: Provide raceways for standardized plug connectors to accommodate up to 12 wires as required for electrified door hardware specified in hardware sets in Division 08: Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.
      i. Doors in wet or humid areas shall have a top cap and solid foam interior core to prevent internal moisture accumulation and galvannealed.
      j. Edge profile shall be provided on both vertical edges of door as follows:
         1) Single-acting swing doors: Beveled 1/8 inch in two inches (2”).
      k. Hardware reinforcements:
         1) Doors shall be mortised, reinforced, drilled, and tapped at factory for fully template hardware, in accordance with the approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only.
         2) Minimum gauges for hardware reinforcing plates shall be as follows:
            a) Hinge and pivot reinforcements: Seven (7) gauge.
            b) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.
   4. Glass moldings and stops: Loose stops shall be not less than 20-gauge steel, with butt corner joints, secured to frame opening by countersunk screws. Snap-on attachments will not be acceptable.
   5. Louvers: Shall be inverted "V" blade, sight-proof type, unless noted otherwise.
   6. Edge clearances:
      a. Between door and frame at head and jambs: 1/8 inch.

b. At doorsills with no threshold: 5/8-inch to 3/4-inch above finished floor.
c. At doorsills with threshold: As required to suit threshold.
d. Between meeting edges of double doors: 1/8 inch.

B. Finish:
1. Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
a. Clean surfaces free of mill scale, rust, oil, grease, dirt, and other foreign matter.
b. Chemically treat surfaces and apply one (1) coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.

2. Field painted under Section 09 90 00: Painting and Coating.

C. Sound Rated Door: STC of 32, measured in accordance with ASTM E413.

D. Thermal Insulated Door: Total insulation R-Value of 44 measured in accordance with ASTM C1363, unless otherwise noted on Drawings.

2.5 LABELED DOORS AND FRAMES

A. Labeled doors and frames shall be provided for openings requiring fire protection ratings as scheduled and to comply with NFPA 80. Such doors and frames shall be constructed as tested and approved by UL, WHI, or other nationally recognized testing agency having a factory inspection service and approved by code authorities having jurisdiction and shall bear the appropriate permanent label.

B. If any door or frame scheduled to be fire-rated cannot qualify for appropriate labeling because of its size, design, hardware, or other reason, the Architect shall be so advised before fabrication work on that item is started. Indicate and highlight on shop drawing.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate the work of this Section.

B. Coordinate hardware installation with opening construction. Finish hardware is specified in Section 08 71 00: Door Hardware.

C. Coordinate doors, frames, and windows with glazing specified in Section 08 80 00: Glazing.

D. Coordinate doors and frames with painting specified in Section 09 90 00: Painting and Coating.

3.2 INSTALLATION

A. Separate dissimilar metals. Protect against galvanic action.

B. Frames:
1. Anchorage and connections: Secure to adjacent construction. Where practical, interior door frames shall be flush with the pull side wall to minimize or eliminate the reveal and allow full 180-degree door swing.
2. Install frames in accordance with manufacturer’s instructions and install labeled frames in accordance with NFPA 80.
3. Frame spreader bars: Leave intact until frames are set perfectly square and plumb

and anchors are securely attached.

4. Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed. Do not remove or paint over labels on labeled frames.

C. Doors:
1. Install hardware in accordance with hardware manufacturer's templates and instructions.
2. Install doors in accordance with manufacturer’s instructions and install labeled doors in accordance with NFPA 80.
3. Adjust operable parts for correct function.
4. Remove hardware, with the exception of prime-coated items, tag, box, and reinstall after finish paint Work is completed. Do not remove or paint over labels on labeled doors.

3.3 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces.

C. Remove scraps and debris, and leave site in clean condition.

END OF SECTION 08 11 13

SECTION 08 14 16 FLUSH WOOD DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. WI Certified, fire-rated and non-rated, flush panel wood doors.
   2. Solid core doors with MDF and plastic laminate faces.
   3. Integration of a security system.
   4. Factory fitting flush wood doors to frames and factory machining for hardware.
   5. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 07 92 00: Joint Sealants.
   3. Section 08 11 13: Hollow Metal Doors and Frames.
   4. Section 09 21 16: Gypsum Board Assemblies.
   5. Section 09 24 00: Cement Plastering.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data for each type of door indicated:
      a. Include details of core and edge construction, louvers, and trim for openings.
      b. Include factory finishing specifications.
      c. Include laboratory test report results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.

B. Shop Drawings:
   1. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
      a. Dimensions and locations of blocking.
      b. Dimensions and locations of mortises and holes for hardware.
      c. Dimensions and locations of cutouts.
      d. Undercuts.
      e. Requirements for veneer matching.
      f. Doors to be factory finished and finish requirements.
      g. Fire-protection ratings for fire rated doors.

C. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for fire rated door assemblies and smoke and draft control door assemblies.

D. Certificate of Compliance regarding WI construction grade.

E. Certificate of Compliance regarding WI installation requirements.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire rated wood doors - NFPA 80 listed and labeled by UL for fire protection ratings indicated, based on testing at positive pressure according to UL 10C:
      a. Oversize fire rated door assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
      b. Temperature rise limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F (250 degrees C) above ambient after 30 minutes of standard fire-test exposure.
   2. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
   3. Accessibility requirements - comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2016 ADA Standards for Accessible Design.
      b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA:
         2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
   4. Quality standard: In addition to requirements specified, comply with Woodwork Institute WI Manual of Millwork
   5. Maintain at least one copy of WI Manual for reference at jobsite throughout installation period.

B. Source Limitations: Obtain flush wood doors through one (1) source from a single manufacturer.

C. Pre-Installation Conference: Conduct conference at site.

1.5 WARRANTY

A. Warranty:
   1. Written warranty signed by manufacturer, installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship. A representative of the door manufacturer shall inspect the installed doors and shall note on the warranty that no provisions of the warranty have been nullified in the manufacture and/or installation:
      a. Failures include, but are not limited to, the following:
         1) Warping (bow, cup, or twist) more than 1/4-inch (6.4 mm) in a 42-inch by 84-inch (1,067 mm by 2,134 mm) section.
         2) Telegraphing of core construction in face veneers exceeding 0.01-inch in a three-inch (0.25 mm in a 76.2 mm) span.
      b. Warranty include installation and finishing that may be required due to repair or replacement of defective doors.
      c. Warranty period for solid core exterior doors: Five (5) years from date of Substantial Completion.
      d. Warranty period for solid core interior doors: Life of installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store wood doors on a flat level surface in a dry, well ventilated, place. Keep wood doors a minimum of 3-1/2 inches (85 mm) off floor surface and protected by a protective covering under the bottom door and over the top door. Covering should protect wood doors from dirt, water, and abuse but allow for air circulation under and around the

stack. Do not store wood doors in direct sunlight. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in heavy duty cardboard cartons prior to shipment from factory. Mark each door on top and bottom rail with opening number used on shop drawings using temporary, removable, or concealed markings.

C. Handle wood doors with clean gloves. Lift and carry wood doors when moving them around the site; do not drag wood doors across one another.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide flush wood door products by one of the following:
1. Haley Brothers, Inc.
2. Oshkosh Door Company.
3. Oregon Door.
4. Weyerhaeuser.
5. Approved equal.

B. Manufacturers are subject to compliance with requirements; provide high pressure laminate products by one of the following:
1. Formica Corp.
2. Panolam Surface Systems.
3. Wilsonart LLC.
4. Approved equal.

C. Fire Rated Wood Doors - Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C:
1. Cores: Provide core specified or mineral core as necessary to provide fire protection rating indicated.
2. Edge construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
3. Pairs: Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
4. Pairs:
    a. Provide formed steel edges and astragals with intumescent seals:
        1) Finish steel edges and astragals with baked enamel same color as doors.
        2) Finish steel edges and astragals to match door hardware (locksets or exit devices).

D. Smoke and Draft Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Particleboard Core Doors:
1. Blocking:
    a. Provide wood blocking in particleboard core doors as necessary to eliminate through-bolting hardware:
        1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
        2) Five-inch (125 mm) bottom rail blocking, in exterior doors and doors

indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.

2. Provide doors with glued wood stave or structural composite lumber cores instead of particleboard cores for doors indicated to receive exit devices.

F. Fire Rated Wood Doors with Plastic Laminate Face - Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C:
1. Core: Noncombustible mineral product complying with requirements and testing and inspecting agency for fire protection rating indicated.
2. Blocking:
a. Provide composite blocking with improved screw-holding capability approved for use in doors of fire protection ratings indicated as follows:
1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
2) Five-inch (125 mm) bottom rail blocking, in doors indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2 inch by 10 inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.
3. Edge Construction:
a. Provide fire rated door edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges:
1) At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance:
a) Screw holding capability: 550 lbf (2440 N) per WDMA T.M.-10.
2) Pairs:
a) Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges. Where required, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.
4. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

2.2 PLASTIC-LAMINATE-FACED DOORS

A. Particleboard Core Doors with Plastic Laminate Face:
1. Grade and construction: WI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
2. Core - ANSI A208.1, particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
3. Blocking:
a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
1) Five-inch (125 mm) top rail blocking. in all doors, whether or not closers are scheduled.
2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.

4. Exposed vertical and horizontal edges - impact resistant polymer edging, applied after faces:
   a. Polymer edging color: Match face color.
5. Construction: Five (5) plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press**.**
6. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
7. Face: 3-ply AWI PC-HPDL-3 High Pressure Decorative Laminate (HPDL).

2.3 PAINTED DOORS (OPAQUE FINISH)

A. Particleboard Core Doors with Painted Finish:
   1. Grade and construction: AWI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
   2. Core - ANSI A208.1, particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
   3. Blocking:
      a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
         1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
         2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
         3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
         4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.
   4. Exposed vertical and horizontal edges:
      a. Seal all exposed edges with primer and provide opaque finish.
      b. Color: Match face color and finish unless noted otherwise.
      c. Labels: Mask labels prior to field painting where doors are not delivered with factory finish.
   5. Construction: Five (5) plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press.
   6. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
   7. Face: Paint grade medium density overlay (MDO).

2.4 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings: Manufacturer’s standard frame formed of 0.048-inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint with baked-enamel or powder-coated finish, and approved for use in doors of fire-protection rating indicated.

C. Metal Louvers:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Air Louvers; a Division of the Activar Construction Products Group.
      b. L & L Louvers.

c. McGill Architectural Products.
d. Approved equal.

2. Blade type: Vision-proof, inverted V.
3. Metal and finish: Hot-dip galvanized steel, 0.040-inch (1.0 mm) thick, factory primed for paint with baked-enamel or powder-coated finish.
4. Metal and finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.

D. Louvers for Fire-Rated Doors - Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Air Louvers; a Division of the Activar Construction Products Group.
b. L & L Louvers, Inc.
c. McGill Architectural Products.
d. Approved equal.
2. Metal and finish: Hot-dip galvanized steel, 0.040-inch (1.0 mm) thick, factory primed for paint with baked-enamel or powder-coated finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated:
1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, BHMA-156.115-W, and hardware templates:
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:
1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles:
a. Fabricate door and transom panels with full-width, solid-lumber**,** rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings:
1. Factory cut and trim openings through doors:
a. Light openings: Trim openings with moldings of material and profile indicated.
b. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors:
1. Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming or factory finishing:
a. Flash top of out-swinging doors with manufacturer's standard metal flashing.

2.6 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one (1) coat of wood primer specified in Section 09 90 00: Painting and Coating.

B. Doors for Transparent Finish: Shop prime faces and all four edges with stain (if required), other required pretreatments, and first coat of finish as specified in Section 09 90 00: Painting and Coating. Seal edges of cutouts and mortises with first coat of finish.

2.7 FACTORY FINISHING

A. General – For factory finish doors, factory finish doors that are indicated to receive transparent finish, and factory finish doors where indicated in schedules or on Drawings as factory finished:
   a. Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing:
      1) Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish:
   1. Grade: Premium.
   2. Finish: WI's Architectural Woodwork Standards System 9, UV curable, acrylated epoxy, polyester, or urethane; refer to Drawings for finish designation.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
   5. Sheen: Semigloss.

C. Opaque Finish:
   1. Grade: Premium.
   2. Finish: AWMAC's and WI's Architectural Woodwork Standards System 10, UV curable, water based; refer to Drawings for finish designation.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Sheen: Semigloss.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

3.2 EXAMINATION

A. Examine doors and installed door frames, with installer present, before hanging doors:
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.3 INSTALLATION

A. Hardware: For installation, see Section 08 71 00: Door Hardware.

B. Installation Instructions:
   1. Install doors to comply with manufacturer's written instructions, referenced quality

standard, and as indicated:
a. Install fire-rated doors according to NFPA 80.
b. Install smoke and draft-control doors according to NFPA 105.

C. Job-Fitted Doors:
1. Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining:
a. Clearances:
1) Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated:
a) Comply with NFPA 80 for fire-rated doors.
b. Bevel non-fire-rated doors 1/8 inch in two inches (2”) - 3-1/2 degrees - at lock and hinge edges.
c. Bevel fire-rated doors 1/8 inch in two inches (2”) - 3-1/2 degrees- at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 71 00

DOOR HARDWARE

1) PART 1 GENERAL

a) SECTION INCLUDES

i) Hardware for doors.

ii) Thresholds.

iii) Gasketting.

iv) Keying.

b) REFERENCES

i) ADA - Americans with Disabilities Act Standards for Accessible Design.

ii) ANSI - American National Standards Institute.

iii) BHMA - Builders' Hardware Manufacturers Association.

iv) CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

v) DHI - Door and Hardware Institute.

vi) DSA - Division of the State Architect.

vii) NFPA 80 - Fire Doors and Windows.

viii) UL - Underwriters Laboratories.

c) COORDINATION

i) Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

d) QUALITY ASSURANCE

i) Manufacturers: Companies specializing in manufacturing door hardware with minimum five years experience. Obtain each kind of hardware from only one manufacturer.

ii) Hardware Supplier: Company specializing in supplying commercial door hardware with five years documented experience.

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

iv) Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this Section.

e) REGULATORY REQUIREMENTS

i) Fire-Rated Openings: Comply with CBC Section 716 and NFPA Standard No. 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels.

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

(2) Exit device shall be compliant with State Fire Marshall Standard 12-10-3, Section 12-10-302.

ii) Conform to applicable requirements of the Americans with Disabilities Act Standards for Accessible Design regarding accessibility requirements for door and entrance hardware.

iii) Doors and doorways that are part of an accessible route shall comply with CBC Sections 11B-404.

iv) The clear opening width for a door shall be 32 inches minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into the opening below 34 inches and 4 inches maximum projections into the opening between 34 inches and 80 inches above the finish floor or ground. Door closers and stops shall be permitted to be 78 inches minimum above the finish floor or ground. CBC Section 11B-404.2.3.

v) Handles, pulls, latches, locks, and other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34 inches minimum and 44 inches maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. CBC Section 11B-404.2.7.

vi) The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9.

(1) Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 lbs. (22.2N) maximum.

(2) Required fire doors: the minimum opening force allowable by the DSA Authority, not to exceed 15 lbs. (66.7N) maximum. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.

(3) The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 lbs. (22.2N) maximum to comply with CBC Section 11B-309.4.

vii) Door closing speeds shall be as follows: CBC Section 11B-404.2.8.

(1) Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum.

(2) Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.

viii) Thresholds shall comply with CBC Section 11B-404.2.5.

ix) Floor stops shall not be located in the path of travel and 4 inches maximum from walls.

x) Hardware (including exit devices) shall not be provided with ANight Latch@ (NL) function for any accessible doors or gates unless the following conditions are met: (Such conditions must be clearly demonstrated and indicated in the specifications)

(1) Such hardware has a >dogging= feature.

(2) It is dogged during the time the facility is open.

(3) Such >dogging= operation is performed only by employees as their job function (non-public use).

xi) Pair of doors: Limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. CBC Section 11B-703.4.2.

f) SUBMITTALS

i) Submit schedule under provisions of Section 01 33 00.
ii) Submit schedule at earliest possible date along with essential product data where acceptance of hardware schedule must precede fabrication of other work.

iii) Organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following:

(1) Type, style, function, size and finish of each hardware item. Use BHMA finish codes as per ANSI A156.18.

(2) Name and manufacturer of each item.

(3) Fastenings and other pertinent information.

(4) Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.

(5) Explanation of all abbreviations, symbols, codes, etc., contained in schedule.

(6) Mounting locations for hardware.

(7) Door and frame sizes and materials.

iv) Provide product data on specified hardware.

v) Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

vi) Furnish hardware templates to each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware.

g) OPERATION AND MAINTENANCE DATA

i) Submit operation and maintenance data under provisions of Section 01 77 00.

ii) Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

h) DELIVERY, STORAGE, AND HANDLING

i) Deliver products to site and to other Sections under provisions of Section 01 60 00.

ii) Store and protect products under provisions of Section 01 60 00.

iii) Package hardware items individually; label and identify package with door opening code to match hardware schedule.

iv) Deliver keys to Owner by security shipment direct from hardware supplier.

i) WARRANTY

i) Provide five year warranty for closers, two year warranty for all other hardware under provisions of Section 01 77 00.

j) MAINTENANCE MATERIALS

i) Provide special wrenches and tools applicable to each different or special hardware component.

ii) Provide maintenance tools and accessories supplied by hardware component manufacturer.

2) PART 2 PRODUCTS

a) ACCEPTABLE MANUFACTURERS

Item		Manufacturer	Acceptable Substitute	
i) Continuous Hinges		Ives	McKinney	Hager
ii)Butt Hinges		Ives	McKinney	Hager
iii)	Locksets	Corbin-Russwin	Owners standard	
iv)	Cylinders	Corbin-Russwin	Owners standard	
v)	Exit Devices	Von Duprin	Owners standard	
vi)	Surface Closers	LCN	Owners standard	
vii)	Anti Vandal Pulls	Ives	Owners standard	
viii)	Protection Plates	Trimco	Rockwood	Ives
ix)	Stops and Holders	Trimco	Rockwood	Ives
x)	Overhead Stops	Glynn Johnson	Rixson	ABH
xi)	Thresholds/Sweeps/Seals	Pemko	Reese	NGP

b) MATERIALS

i) Locksets: Mortise and cylindrical type. 16 gage curved steel, bronze or brass strikes with 2 inch deep box construction, with curved lips of sufficient length to clear trim and protect clothing.

(1) Comply with requirements of local security ordinances.

(2) Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.

(3) Lock series and design: Corbin-Russwin CL3300 series NZD lever and ML2000 series NSA lever.

ii) Butt Hinges: Outswinging exterior doors shall have non-removable (NRP) pin. Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Furnish hinges with stainless steel pins and ball bearings.

(1) Furnish 3 hinges per leaf to 7'-5" height. Add one for each additional 2 foot height.

(2) Provide 5 inch heavy weight hinges on doors over 3'-4" width.

iii) Continuous Hinges: Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Where necessary to maintain door clearance at jamb trim, frame conditions, door reveals and similar conditions, furnish wide throw hinges as approved by the Architect. Where door is indicated as having fire resistance rating, provide UL listed and labeled hardware.

iv) Panic Hardware: Furnish exit devices with sex bolts at wood doors. Lever handle trim shall match locksets. Device shall bear UL label for fire and or panic as may be required.

1. Provide glass bead kits of proper thickness where the rail assembly of the exit device crosses a lite.

v) Surface Door Closers: Full rack and pinion type with removable non-ferrous case. Provide closers with sex bolts and grommets at wood doors. Place closers inside building, stairs, rooms, etc. Closers shall be non-handed, non-sized and adjustable. Closers shall be installed to permit door to swing 180 degrees.

(1) Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.

(2) Provide drop brackets, shoe supports, and blade stop spacers as required at narrow top rails.

vi) Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges, height called for in schedule by width of door less 2 inches. Furnish with machine or wood screws of bronze or stainless steel to match other hardware.

vii) Floor Stops: Floor mounted door stops are prohibited where located in the path of travel. Where provided, install maximum 4 inches from wall surface.

viii) Seals: Solid neoprene to be MIL Spec. R6855-CL III, Grade 40. Sponge neoprene to be MIL Spec. R6130, Type II, Group C. UL label shall be applied on all rated doors.

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

x) Thresholds: Change in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater that 1 unit vertical to 2 units horizontal (50 percent slope). The floor or landing shall not be more that 1/2 inch lower than the threshold of the doorway.

c) KEYING

i) Contact the District Locksmith with Westminster School District (714-894-7311) for keying requirements. Keying system shall be coordinated with the Owner and approved by Owner=s representative in writing. Furnish construction key system in accordance with lock manufacturers' standard. Where interchangeable core systems are used, provide temporary cores for construction keying.

ii) Key system shall be Corbin-Russwin, LFIC cylinders, 6-pin.

iii) For protection of the Owner, key cylinders at the factory of the cylinder manufacturer where permanent records are maintained. Permanently inscribe each key with number that identifies cylinder manufacturer key symbol, and notation 'DO NOT DUPLICATE".

iv) Deliver permanent keys and cylinder cores directly to Owner by registered security shipment direct from hardware manufacturer. Hardware supplier shall not cut keys.

d) LOCK BOX

i) Model No. 3200 lock box manufactured by the Knox Company, www.knoxbox.com..

ii) Surface or recess mounted as required.

iii) Polyester powder coated finish in black color.

iv) UL listed tamper switch.

e) FINISHES

i) Generally to be BHMA 626 Satin Chromium.

ii) Areas using BHMA 626 shall have push, pulls and kick plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.

iii) Factory paint door closers to match other hardware, unless otherwise noted.

iv) Aluminum items to be finished AL unless otherwise noted.

f) FASTENERS

i) Screws for strikes, face plates and similar items shall be flathead, countersunk type; provide machine screws for metal and standard wood screws for wood.

ii) Screws for butt hinges shall be flathead, countersunk, full-thread type.

iii) Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

iv) Provide expansion anchors for attaching hardware items to concrete or masonry.

v) All exposed fasteners shall have a phillips head.

vi) Finish of exposed screws to match surface finish of hardware or other adjacent work.

g) OTHER MATERIAL

i) All other materials not specifically described, but required for a complete and proper finish hardware installation shall be selected by Architect as required at no additional cost.

3) PART 3 EXECUTION

a) INSPECTION

i) Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.

ii) Verify that power supply is available to power operated devices.

iii) Beginning of installation means acceptance of existing conditions.

b) INSTALLATION

i) Pre-Installation Meetings: Initiate and conduct with supplier, installer, and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware, and door closers in the meetings. Convene at least one week prior to commencement of related work.

ii) Install hardware in accordance with manufacturer's instructions and requirements of DHI.

iii) Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in Division 9. Do not install surface-mounted items until finishes have been completed on the substrate.

iv) Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

v) Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

vi) Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor, providing a continuous weather seal. Anchor thresholds with stainless steel countersunk screws.

vii) If handle of door is changed during construction, make necessary changes in hardware at no additional cost.

viii) Mount lock box in accordance with manufacturers instructions. Connect to building security system. Mount at 4'-0" from finished grade to center of box.

c) ADJUST AND CLEAN

i) Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

ii) Clean adjacent surfaces soiled by hardware installation.

iii) Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

iv) Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

v) Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor, accompanied by the Finish Hardware Installer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

d) HARDWARE LOCATIONS

i) Lockset: 34 to 44 inches above finished floor. Verify manufacturers' template with door design.

ii) Door Pull: 40 inches from bottom of door to center of pull.

iii) Panic Device: 36 to 44 inches above finished floor. Verify manufacturers' template with door design.

iv) Conform to CBC, CCR, Title 24, Part 2, and ADA regarding positioning requirements for accessibility.

e) FIELD QUALITY CONTROL

i) Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

f) SCHEDULE

i) Legend of listed manufacturers. The last column in the Schedule of Door Hardware refers to the manufacturer listed in the following schedule:

COR	Corbin-Russwin
GLY	Glynn Johnson
IVE	Ives
LCN	LCN
PEM	Pemko
TRM	Trimco
VON	Von Duprin

ii) The items listed in the following schedule shall conform to the requirements of the foregoing specification.

iii) The Door Schedule on the Drawings indicates which hardware set is used with each door.

D. Schedule of Door Hardware:

HW-1
Each single door to have

1	CONTINUOUS HINGE	112HD	628	IVE
1	EXIT DEVICE	AX-PA-CD-98NL-OP x 110NL	626	VON
1	MORTISE CYLINDER	1080-CT6	626	COR
1	RIM CYLINDER	3080-CT6	626	COR
2	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	SURFACE CLOSER	4040XP-SCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike
Note: Adjust exit device backset to compensate for strike jamb seal

HW-2
Each single door to have

3	HINGE	5BB1 - 4.5 x 4.5	652	IVE
1	PRIVACY	ML2060-NSA-M17-M19V-M34-SA114	626	COR
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	COAT HOOK	3071	626	TRM
3	SILENCERS	1229A	GRY	TRM
1	THRESHOLD	PER SILL DETAIL	---	---

HW-3
Each single door to have

1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	CONTINUOUS HINGE	112HD	628	IVE
1	EXIT DEVICE	AX-PA-CD-98NL-OP x 110NL	626	VON
1	MORTISE CYLINDER	1080-CT6	626	COR
1	RIM CYLINDER	3080-CT6	626	COR
2	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	SURFACE CLOSER	4040XP-EDA x ST1944	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	WALL BUMPER	1270CVPV	626	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer and rim strike
Note: Adjust exit device backset to compensate for strike jamb seal

HW-4
Each single door to have

1	CONTINUOUS HINGE	112HD	628	IVE
1	DEADBOLT	DL3012-CT6	626	COR
2	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR900	630	IVE
1	PUSH PLATE	1001-11 - 8 x 16 x CFC	630	TRM
1	SURFACE CLOSER	4040XP-SHCUSH x ST1595	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	2893V HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

Note: Install door seals before closer

HW-5
Each single door to have

3	HINGE	5BB1 - 4.5 x 4.5	652	IVE
1	LATCHSET	CL3310-NZD-M17	626	COR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	900S	630	GLY
3	SILENCERS	1229A	GRY	TRM

END OF SECTION

SECTION 09 29 00 GYPSUM BOARD

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes requirements including but not limited to:
1. Paper faced gypsum board.
2. Mold, mildew, moisture resistant paper faced gypsum board.
3. Fiberglass mat faced gypsum board.
4. Cement board.
5. Texture finishes.
6. Accessories.
7. Trim.
8. Joint tape.
9. Joint compounds.

B. Related Sections:
1. Section 05 50 00: Metal Fabrications.
2. Section 06 10 00: Rough Carpentry.
3. Section 08 11 13: Hollow Metal Doors and Frames.
4. Section 09 30 00: Tiling.
5. Section 09 90 00: Painting and Coating.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI A108 Interior Installation of Cementitious Backer Units.

B. ASTM International (ASTM):
1. ASTM C475/C475M Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board.
3. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications.
4. ASTM C1002 Standard Specifications for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
5. ASTM C1178/C1178M Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
6. ASTM C1325 Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.
7. ASTM C1396/C1396M Standard Specification for Gypsum Board.
8. ASTM C1629/C1629M Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
9. ASTM C1658/C1658M Standard Specification for Glass Mat Gypsum Panels.
10. ASTM C1766 Standard Specification for Factory-Laminated Gypsum Panel.
11. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
12. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

13. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

C. Gypsum Association (GA):
1. GA-214 Recommended Levels of Gypsum Board Finish.
2. GA-216 Application and Finishing of Gypsum Panel Products.

1.4 SUBMITTALS

A. Product Data: Submit for each type of drywall including calculations for loadings and stresses of exterior walls and specially fabricated framing based on manufacturer's load tables.
1. Gypsum Board.
2. Foil Backed Gypsum
3. Cementitious Board.
4. Texture finishes.
5. Trim accessories.
6. Samples
7. Textured Finishes: Apply to gypsum board, 4 by 6 inches.
8. Trim Accessories: 12-inch length of trim.

B. Shop Drawings: Indicate locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

C. Samples:
1. Trim Accessories: Full size Sample in 12 inch (300 mm) long length for each trim accessory indicated.
2. Textured Finishes: 12 inches by 12 inches (300 mm by 300 mm) for each textured finish indicated and on same backing indicated for Work.

D. Calculations: Submit calculations verifying steel partition stud minimum base metal thickness and depth compliance with Code and ASTM C645 for height, load, and deflection.

E. Evaluation Reports: ICC-ES reports for dimpled steel studs and runners and firestop tracks.

F. Sustainable Design Submittals.
1. Sustainable Design closeout Requirements.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA):
   a. CBC-7 – Chapter 7, Fire Resistant Materials and Construction
   b. CBC-19A – Chapter 19A, Concrete
   c. CBC – Chapter 25, Gypsum Board and Plaster.
2. Division of the State Architect, Interpretation of Regulations (DSA-IR):
   a. DSA-IR 25-3, Drywall Ceiling Suspension Conventional Construction-One Layer.
   b. DSA-IR 25-2.13, Metal Suspension Systems for Lay in Panel Ceilings.
3. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. Single Source Responsibility:

1. Framing Members: Obtain steel framing members from single manufacturer.
2. Panel Products: Obtain each type of gypsum board and other panel products from single manufacturer.
3. Finishing Materials: To the extent possible, obtain finishing materials from same manufacturer supplying gypsum board products. When not possible, obtain materials from manufacturer acceptable to gypsum board manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design: Products from **National Gypsum Company**, 2001 Rexford road, Charlotte, North Carolina 2811. 704-365-7300 ng@nationalgypsum.com.
   1. All other manufacturers are subject to compliance with requirements to match or exceed products listed here-in.

2.2 PAPER FACED GYPSUM BOARD

A. Gypsum Board, Regular Core, ASTM C1396/C1396M:
   1. Gold Bond® Gypsum Board.
   2. Gold Bond® High Strength LITE® Gypsum Board.
   3. Gold Bond® High Flex® Gypsum Board.
      a. Thickness: 1/2 inch.
      b. Core: Regular.
      c. Edges: Square.

B. Gypsum Board, Fire-Resistant Core: ASTM C1396/C1396M.
   1. Gold Bond® Fire-Shield C™ 1/2" Gypsum Board.
   2. Gold Bond® Fire-Shield C™ 5/8" Gypsum Board.
      a. Thickness:5/8 inch
      b. Core: Type X
      c. Edges:]Square.

C. Gypsum Board, Fire-Resistant Core, Foil Backed: ASTM C1396/C1396M.
   1. Gold Bond® High Strength Fire-Shield 30® Gypsum Board.
   2. Gold Bond® High Strength Fire-Shield 60® Gypsum Board.
   3. Gold Bond® Ultra-Shield FS® 3/4" Gypsum Board.
   4. Gold Bond® Foil Back Gypsum Board.
      a. Thickness: 5/8 inch.
      b. Core: Type X.
      c. Edges: Square.

D. Gypsum Board, Fire-Resistant Core, Prefinished: ASTM C1396/C1396M.
   1. Gold Bond® Durasan® Prefinished Gypsum Board.
      a. Thickness: 5/8 inch
      b. Core: Type X.

c. Edges: Beveled.
d. Vinyl Face: where applicable, refer to Finish Drawings.

2.3 MOLD, MILDEW, MOISTURE RESISTANT PAPER FACED GYPSUM BOARD

A. Gypsum Board, Regular Core, Mold, Mildew, Moisture Resistant: ASTM C1396/C1396M.
1. Gold Bond® XP® Gypsum Board.
a. Thickness: 1/2 inch.
b. Core: Regular.
c. Edges: Square
d. Mold/Mildew Resistance: ASTM D3273; Score of 10.
e. Mold/Mildew Resistance: ASTM G21, Score of 0.

B. Gypsum Board, Fire Resistant Core, Mold, Mildew Moisture Resistant: ASTM C1396/C1396M.
1. Gold Bond® XP® Fire-Shield® Gypsum Board.
2. Gold Bond® XP® Fire-Shield® 5/16" Gypsum Board.
3. Gold Bond® XP® Fire-Shield C™ 1/2" Gypsum Board.
4. Gold Bond® XP® Fire-Shield C™ 5/8" Gypsum Board.
5. Gold Bond® XP® Ultra-Shield FS® 3/4" Gypsum Board.

C. Gypsum Board, Mold, Mildew, Moisture, and Abuse Resistant: ASTM C1396/C1396M.
1. Gold Bond® XP® Hi-Abuse® Gypsum Board.
a. Thickness: 5/8 inch.
b. Core: Type X.
c. Edges: Tapered.
d. Mold/Mildew Resistance: ASTM D3273; Score of 10.
e. Surface Abrasion: ASTM C1629/C1629M; Level 3.
f. Indentation: ASTM C1629/C1629M; Level 1.
g. Soft-Body Impact: ASTM C1629/C1629M; Level 2.
h. Hard-Body Impact: ASTM C1629/C1629M; Level 1.

D. Gypsum Board, Mold, Mildew, Moisture Resistant, with Sound Dampening: ASTM C1396/C1396M and ASTM C1766.
1. Gold Bond® SoundBreak XP Wall® Board.
2. Gold Bond® SoundBreak XP Ceiling® Board.

2.4 CEMENT BOARD

A. Cement Board, Backer, Interior/Exterior: ASTM C1325.
1. PermaBASE® Cement Board.
2. PermaBASE PLUS® Cement Board.
a. Thickness: 5/8 inch
b. Weight: 2.9 lbs./sq.ft.
c. Edges: Round.
d. Mold/Mildew Resistance: ASTM D3273; Score of 10.
e. Shear Bond Strength: 241 psi.

B. Cement Board, Interior Underlayment: ASTM C1325.
1. PermaBASE UltraBacker® Cement Board.
a. Thickness: 1/4 inch.
b. Weight: 1.8 lbs./sq.ft.
c. Edges: Round.
d. Mold/Mildew Resistance: ASTM D3273; Score of 10.

2.5 TEXTURE FINISHES

A. Primer: Manufacturer recommended for surface being coated.

B. Non-Aggregated Wall and Ceiling Texture:
1. ProForm™ Wall and Ceiling Spray.
2. ProForm™ Perfect Spray® EM.
   a. Texture: Spray spatter
   b. Polystyrene Aggregate Ceiling Texture:
3. ProForm™ Perfect Spray® Medium.
   a. Texture: Fine

2.6 ACCESSORIES

A. Acoustical Sealant: ASTM C919.
1. Manufacturers and Products:
   b. Grabber Construction Products; Acoustical Sound and Smoke Sealant GSCSF.
   a. Specified Technologies Inc.; SpecSeal SNS Smoke N Sound Acoustical Sealant.
   b. BOSS Products; BOSS 826 Acoustical Acrylic Sound Sealant.

B. Firestopping: ASTM E814.
1. Manufacturers and Products:
   a. Specified Technologies Inc.; SpecSeal SSP Putty & Putty Pads.
   b. BOSS Products; BOSS 818 Fire Rated Putty Pads.

C. Fasteners for Cement Board: ASTM C1002.
1. PermaBASE™ Cement Board Screws Hi-Lo.
   a. Wafer head, corrosion-resistant.
   b. Thickness, overall: [1-1/4 inch][2 inch][2-1/2 inch].
2. PermaBASE™ Cement Board Screws Drill Point.
   a. Wafer head, corrosion-resistant.
   b. Thickness, overall: [1-1/4 inch][2 inch][2-1/2 inch].

D. Fasteners for Tile Backer: ASTM C1002.
1. Fasteners for 1/2 inch thick panels:
   a. Wood Framing: [1-1/4 inch minimum galvanized roofing nail][1-1/4 inch minimum corrosion resistant course thread bugle head].
   b. Metal Framing: 1 inch minimum corrosion resistant sharp point or drill point bugle head screw.

E. Fasteners for 5/8 inch thick panels:
1. Wood Framing: [1-3/4 inch minimum galvanized roofing nail][1-1/4 inch minimum corrosion resistant course thread bugle head][As required by fire-rated assembly].
2. Metal Framing: [1-1/4 inch minimum corrosion resistant sharp point or drill point bugle head screw][As required by fire-rated assembly].

2.7 TRIM

A. Vinyl Trim:
1. One-Piece: Extruded vinyl form; vinyl coating matching boards.(1/2 inch Board)
2. Two-Piece: Extruded vinyl form; vinyl coating matching boards.(5/8 inch Board)

2.8 JOINT TAPE

A. Paper Tape: 2-1/16 inch wide, cross-fibered paper, ASTM C475/C475M.

1. ProForm™ Paper Joint Tape.

B. Fiberglass Mesh Tape: Polymer-coated (alkali-resistant) fiberglass mesh.
   1. PermaBASE™ Cement Board Tape, 4 inch

2.9 JOINT COMPOUNDS

A. Setting Type Compound
   1. Field mixed quick setting and hardening: ASTM C475/C475M.
      a. ProForm® Quick Set™ Setting Compound.
   2. Field mixed quick setting and hardening; fire resistant: ASTM E814.
      a. ProForm® Quick Set™ Fire and Smoke Stop 90 Setting Compound.

B. Drying Type Compound:
   1. Ready mix, vinyl base: ASTM C475/C475M.
      a. ProForm® Multi-Use Joint Compound.
      b. ProForm® All Purpose Joint Compound.
      c. ProForm® Ultra Lite® All Purpose Joint Compound.
      d. ProForm® All Purpose Machine Grade Joint Compound.
      e. ProForm® Lite Blue™ Joint Compound.
      f. ProForm® Lite Joint Compound.
   2. Ready mix, vinyl base, reduced dust: ASTM C475/C475M.
      a. ProForm® All Purpose with Dust-Tech® Joint Compound.
      b. ProForm® Lite with Dust-Tech®.
      c. ProForm® Lite Blue™ with Dust-Tech® Joint Compound.
         1) Mold/Mildew Resistance: ASTM D3273; Score of 10.
         2) Mold/Mildew Resistance: ASTM G21, Score of 0.
   3. Ready mix, vinyl base, topping compound: ASTM C475/C475M.
      a. ProForm® Topping Joint Compound.
   4. Ready mix, vinyl base, embedding tape and trim: ASTM C475/C475M.
      a. ProForm® Taping Joint Compound.
      b. ProForm® Taping Lite Joint Compound.
   5. Ready mix, vinyl base, specialty: ASTM C475/C475M.
      a. ProForm® All Purpose Texture Grade Joint Compound.
      b. ProForm® All Purpose Heavy Viscosity Joint Compound.
      c. ProForm® Tinted Lite™ Joint Compound.
      d. ProForm® Concrete Cover Joint Compound.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Comply with ASTM C840 for gypsum board manufacturer's written instructions, whichever are more stringent:
      e. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.

B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

D. Do not install panels that are wet, moisture damaged, and mold damaged:
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.2 EXAMINATION

A. Examine areas and substrates including welded hollow metal frames, cast in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.4 INSTALLATION

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated. Install in accordance with:
   1. Manufacturer recommendations.
   2. ANSI A108.
   3. GA-214.
   4. GA-216.

B. Gypsum Board Assemblies: Comply with requirements in ASTM C840 applicable to framing installation.

C. Gypsum Board:
   1. Install interior gypsum board where indicated on drawings.
      a. Single Layer Application:
         1) On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
         2) On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and minimize end joints. Stagger abutting end joints not less than one framing member in alternate courses of panels.
         3) Fastening Methods: Apply gypsum panels to supports with steel drill screws.
      b. Multilayer Application:
         1) On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
         2) On Z shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
         3) Fastening Methods: Fasten base layers and face layers separately to

supports with screws.

D. Cementitious Backer Units: ANSI A108.11; install where indicated with 1/4-inch (6.4 mm) gap where panels abut other construction or penetrations. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

E. Exterior Gypsum Board Soffits:
1. Apply panels perpendicular to supports, with end joints staggered and located over supports:
   a. Install with 1/4 inch open space where panels abut other construction or structural penetrations.
   b. Fasten with corrosion-resistant screws.

F. Trim Accessories:
1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Attach trim according to manufacturer's written instructions:
   a. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
   b. Exterior Trim:
      1) Install in the following locations:
         a) Cornerbead: Use at outside corners.
         b) LC Bead: Use at exposed panel edges.
   c. Interior Trim - Install in the following locations:
      1) Cornerbead: Use at outside corners, unless otherwise indicated.
      2) Bullnose Bead: Use at outside corners.
      3) LC Bead: Use at exposed panel edges.
      4) L Bead: Use where indicated or necessary.
      5) U Bead: Use at exposed panel edges.

G. Gypsum Board Finishing:
1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces:
   a. Prefill open joints, rounded or beveled edges, and damaged surface areas.
   b. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
   c. Gypsum Board Finish Levels - Finish panels to levels indicated below and according to ASTM C840:
      1) Level 1: Ceiling plenum areas, concealed areas, and where indicated.
      2) Level 2: Panels that are substrate for tile.
      3) Level 3: Surfaces be coated with drywall primer prior to final finishes. Heavy or medium texture finishes before final painting, or where heavy-grade wall coverings are to be applied as the final decoration. This level of finish is not recommended where smooth painted surfaces, or light to medium weight wall coverings as specified.
      4) Level 4: For surfaces receiving wall covering and flat paints.
      5) Level 5: For surfaces receiving gloss or semigloss paint and surfaces subjected to severe lighting. To be used in Kitchen areas and food service areas only.
   d. Glass Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
   e. Glass Mat Faced Panels: Finish according to manufacturer's written instructions.

H. Installation Tolerances:

1. Suspension System: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
2. Installation Tolerances, Suspension System: Install suspension systems level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged:
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 00 TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Ceramic mosaic tile.
   2. Accessories required for indicated installation.

B. Related Sections:
   1. Section 09 21 16: Gypsum Board Assemblies.
   2. Section 09 65 13.13: Resilient Base.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction:
   1. Level Surfaces: Minimum 0.6.
   2. Ramp Surfaces: Minimum 0.8.

B. Ceramic Tile Flooring should be stable, firm, and slip resistant, pursuant to 2022 CBC Section 11B-302.1.

1.4 SUBMITTALS

A. Product Data: Technical data including data sheets, installation recommendation, and recommended joint widths.

B. Shop Drawings - Show locations of each type of tile and tile pattern:
   1. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples - Submit samples showing full range of color and texture variations expected:
   1. Full size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required; minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed work.
   3. Waterproof membrane in 6 x 6-inch sample.
   4. Thresholds in 6-inch (150 mm) lengths.

D. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements for slip resistance.

E. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for the CBC for interior finishes.
   2. Surface Burning Characteristics - ASTM E84; identify products with appropriate markings of applicable testing agency:
      a. Flame Spread Index: 25 or less.
      b. Smoke Developed Index: 450 or less.
   3. Accessibility Requirements - Comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
      b. 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA):
         2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

B. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products - Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
   1. Stone thresholds.
   2. Waterproofing.
   3. Joint sealants.
   4. Cementitious backer units.
   5. Metal edge strips.

E. Mockups:
   1. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
      a. Build mockup of each type of floor tile installation.
      b. Build mockup of each type of wall tile installation.
      c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided. Store liquid materials in unopened containers and protected from freezing.

C. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

PART 2 PRODUCTS

2.1 MATERIALS

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting:
   1. For factory mounted tile, provide back or edge mounted tile assemblies as standard with manufacturer unless otherwise indicated:
      a. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.2 TILE PRODUCTS

A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   1. Ceramic Tile:
      a. American Marazzi Tile, Inc.
      b. American Olean; a Division of Dal-Tile Corporation.
      c. Crossville, Inc.
      d. Daltile.
      e. Emser Tile.
      f. Trinity Tile.
      g. Interceramic.
      h. Concept Surfaces, LLC.

B. Ceramic Floor Tile - Factory mounted unglazed ceramic mosaic tile:
   1. Basis of Design Product/Manufacturer: As indicated in the Drawings.
   2. Type: As indicated in the Drawings.
   3. Module Size: Refer to Finish Schedule in the Drawings.
   4. Thickness: 1/4 inch (6.4 mm).
   5. Face: Plain with cushion edges.
   6. Surface: Smooth, without or slip resistant, with abrasive admixture.
   7. Dynamic Coefficient of Friction: Not less than 0.42.
   8. Location: As indicated in the Drawings.
   9. Grout Color: As indicated in the Drawings.
   10. Tile color: As indicated on Drawings or as selected by Architect.

C. Ceramic Wall Tile - Glazed tile:
   1. Basis of Design Product/Manufacturer: **Daltile**
   2. Composition: Impervious natural clay tile.
   3. Module Size: 4 1/4 inches, square.
   4. Thickness: 5/16 inch (8 mm).
   5. Face: Plain with cushion edges.
   6. Surface: Matte glazed.
   7. Base: Six (6) inch high x Six (6) inch wide ceramic tile cove base to match wall tile.

8. Tile Color and Pattern: Refer to Drawings.
9. Grout Color: Selected by Architect unless noted otherwise.
10. Trim Units - Coordinated with sizes and coursing of adjoining flat tile where applicable matching characteristics of adjoining flat tile. Provide shapes selected from standard shapes:
    i. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inch by 1 inch (50.8 mm by 25.4 mm) or 2 inch by 2 inches (50.8 mm by 50.8 mm).
    j. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
    k. External Corners for Thinset Mortar Installations: Surface bullnose, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inch by 1 inch (50.8 mm by 25.4 mm) or 2 inch by 2 inches (50.8 mm by 50.8 mm).
    l. Internal Corners: Cove, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inches by 1 inch (50.8 mm by 25.4 mm).
    m. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
    n. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.4 mm) across nominal 4 inch (100 mm) dimension.

D. Threshold - Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes:
1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
2. Granite Thresholds - ASTM C615/C615M, with polished finish:
    a. Description: Uniform, medium grained, black stone without veining.

2.3 WATERPROOF MEMBRANE

A. Waterproof membrane complies with ANSI A118 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
1. Basis of Design - Laticrete 9235 Waterproofing Membrane. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
    a. Laticrete International, Inc.
    b. MAPEI Corporation.
    c. TEC; H.B. Fuller Construction Products Inc.

C. Fabric Reinforced, Fluid Applied Membrane - System consisting of liquid latex rubber or elastomeric polymer and continuous fabric reinforcement:
1. Basis of Design - Laticrete 9235 Waterproofing Membrane and reinforcing Fabric. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
    a. Laticrete International, Inc.
    b. MAPEI Corporation.
    c. Merkrete by Parex USA, Inc.

D. Latex Portland Cement Waterproof Mortar - Flexible, waterproof mortar consisting of cement based mix and latex additive:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:

a. C-Cure.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.

E. Liquid Latex Waterproofing/Crack Isolation Membrane - Single Component, self-curing, load bearing liquid rubber polymer that forms a flexible seamless combined waterproofing membrane and crack isolation membrane compliance with ANSI A118:
1. Basis of Design - Hydroban by Laticrete International. Subject to compliance with requirements, provide basis of design or comparable product by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.

2.4 CRACK ISOLATION MEMBRANE

A. Crack isolation membrane complying with ANSI A118 for standard performance and recommended by manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric Reinforced, Modified Bituminous Sheet - Self adhering, modified bituminous sheet with fabric reinforcement facing; 0.040-inch (1 mm) nominal thickness:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Custom Building Products.
b. MAPEI Corporation.

C. Fluid Applied Membrane - Liquid latex rubber or elastomeric polymer:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Custom Building Products.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. Merkrete by Parex USA, Inc.
e. TEC; H.B. Fuller Construction Products Inc.

D. Fabric Reinforced, Fluid Applied Membrane - System consisting of liquid latex rubber or elastomeric polymer and fabric reinforcement:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Bonsal American, an Oldcastle company.
b. Bostik, Inc.
c. Custom Building Products.
d. Laticrete International, Inc.
e. MAPEI Corporation.
f. Merkrete by Parex USA, Inc.

2.5 SETTING MATERIALS

A. Dry Set Mortar (Thinset) - ANSI A108:
1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
a. Portland Cement: ASTM C150, Type 1.
b. Sand: ASTM C144.
c. Water: Potable.
2. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Custom Building Products.

b. Laticrete International, Inc.
c. MAPEI Corporation.

3. Wall Applications: Provide mortar complying with requirements for nonsagging mortar in addition to requirements in ANSI A108.

B. Modified Dry Set Mortar (Thinset) - ANSI A118:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at site.
3. Wall Applications: Provide mortar complying with requirements for nonsagging mortar in addition to requirements in ANSI A118.

C. Improved Modified Dry Set Mortar (Thinset) - ANSI A118:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.
3. For wall applications, provide mortar complying with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.

D. Modified Dry Set Mortar (Medium Bed): ANSI A118; product approved by manufacturer for application thickness of 5/8 inch (16 mm).
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.

E. Portland Cement Mortar (Thickset) Installation Materials - ANSI A108:
1. Mortar Bed - Proportions of 1 part Portland Cement to 5 parts sand:
a. Portland Cement: ASTM C150, Type 1.
b. Sand: ASTM C144.
c. Water: Potable.
2. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.
3. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57 mm) diameter; comply with ASTM A1064, except for minimum wire size.
4. Expanded Metal Lath - Diamond mesh lath complying with ASTM C847:
a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
b. Base Metal and Finish for Exterior Applications: Zinc coated (galvanized) steel sheet.
c. Configuration over Studs and Furring: Flat.
d. Configuration over Solid Surfaces: Self furring.
e. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).

5. Latex Additive: Styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with field mixed portland cement and aggregate mortar bed.

F. Tile Setting Epoxy - ANSI A118, water cleanable; 100 percent solids epoxy grout:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
   b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees C and 100 degrees C), respectively, and certified by manufacturer for intended use.
3. Color: Selected by Architect.

G. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thinset) - ANSI A118:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Laticrete International, Inc.
   b. MAPEI Corporation.
   c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.

2.6 GROUT MATERIALS

A. Sand Portland Cement Grout - ANSI A108, consisting of white or gray cement and white or colored aggregate as required to produce color indicated:
1. Portland Cement: ASTM C150, Type 1.
2. Lime: ASTM C206, Type S.
3. Sand: ASTM C144.

B. Commercial Cement Grout (Sanded Grout) - ANSI A118 for joints 1/8 inch (3.2 mm) or wider:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Custom Building Products.
   b. Laticrete International, Inc.
2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid latex form for addition to prepackaged dry grout mix.

C. High Performance Tile Grout - ANSI A118:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Custom Building Products.
   b. Laticrete International, Inc.
2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid latex form for addition to prepackaged dry grout mix.

D. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

E. Water Cleanable Epoxy Grout - ANSI A118:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
   b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
   c. MAPEI Corp., Kerapoxy or Kerapoxy CQ Epoxy Grout.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees and 100 degrees C), respectively, and certified by manufacturer for intended use.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex modified, portland cement-based formulation provided or approved by manufacturer of tile setting materials for installations indicated.

B. Vapor Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.

C. Metal Edge Strips:
1. Angle or L-shaped, height to match tile and setting bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A666, 300 Series exposed edge material.
   a. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      1) Blanke Corporation.
      2) Ceramic Tool Company, Inc.
      3) Schluter Systems L.P.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Tile and Grout Sealer - Sealer for sealing grout joints and that does not change color or appearance of grout:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   a. Custom Building Products.
   b. Summitville Tiles, Inc.
   c. TEC; H.B. Fuller Construction Products Inc.

F. Sealant: Silicone sealant; refer to Section 07 92 00.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

C. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

3.2 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents:
   1. Tile and Trim Units: Furnish quantity of full size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

3.3 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of the work:
   1. Verify substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108 for installations indicated.
   2. Verify concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108 for installations indicated:
      a. Verify surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108 and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at site before installing.

3.5 INSTALLATION

A. Comply with TCNA *Handbook for Ceramic, Glass, and Stone Tile Installation* for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series *Specifications for Installation of Ceramic Tile* that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used:
   1. For the following installations, comply with ANSI A108 series procedures for tile installation standards for providing 95 percent mortar coverage:
      a. Exterior tile floors.
      b. Tile floors in wet areas.
      c. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
      d. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so tiles are flush.

F. Jointing Pattern:
   1. Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated:
      a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
      b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
      c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths - Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints:
   1. Provide expansion joints and sealant filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installing tiles:
      a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Thresholds:
   1. Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated:
      a. At locations where mortar bed (thickset) would otherwise be exposed above

adjacent floor finishes, set thresholds in modified dry set mortar (thinset).
b. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in standard dry set, modified dry set or improved modified dry set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing, or crack isolation membrane with elastomeric sealant.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

L. Floor Sealer: Apply floor sealer to grout joints according to floor sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

M. Waterproofing:
1. Install waterproofing to comply with ANSI A108 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate:
   a. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

N. Crack Isolation Membrane:
1. Install crack isolation membrane to comply with ANSI A108 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate:
   a. Allow crack isolation membrane to cure before installing tile or setting materials over it.

O. Floor and Paver Tile and Planks - Install tile to comply with requirements in the TCNA installation methods and ANSI A108 series of tile installation standards:
1. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   a. Exterior tile floors.
   b. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
   c. Tile floors composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
   d. Tile floors composed of rib backed tiles.

P. Floor Tile - Install tile to comply with requirements in the TCNA installation methods and ANSI A108 series of tile installation standards:
1. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   a. Exterior tile floors.
   b. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
   c. Tile floors composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.
   d. Tile floors composed of rib backed tiles.
2. Tile Installation Method:
   a. Interior Floor Installations, Concrete Subfloor:
      1) TCNA F125-Full; thinset mortar on crack isolation membrane.

Q. Wall Tile Installation:
1. Install types of tile designated for wall installations to comply with requirements, including those referencing TCNA installation methods and ANSI setting bed standards:

a. Back Buttering - For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   1) Exterior tile wall installations.
   2) Tile wall installations in wet areas, including showers, tub enclosures, laundries, and swimming pools.
   3) Tile installed with chemical resistant mortars and grouts.
   4) Tile wall installations composed of tiles 8 inches by 8 inches (203 mm by 203 mm) or larger.

a. Tile Installation Method, Wood or Metal Studs:
   1) TCNA W245; thinset mortar on glass-mat, water-resistant gypsum backer board.

3.6 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning:
   1. On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter:
      a. Remove grout residue from tile as soon as possible.
      b. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 00

SECTION 09 51 00 ACOUSTICAL CEILING PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Acoustical panels.
   2. Concealed and exposed suspension systems for ceilings.
   3. Ceiling panel for food service area.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each product including installation instructions.

B. Samples:
   1. Acoustic Panel: Set of 6-inch (150 mm) square samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch (300 mm) long samples of each type, finish, and color.

C. Coordination Drawings:
   1. Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
      a. Suspended ceiling components.
      b. Structural members to which suspension systems will be attached.
      c. Size and location of initial access modules for acoustical panels.
      d. Items penetrating finished ceiling including but not limited to the following:
         1) Lighting fixtures.
         2) Air outlets and inlets.
         3) Speakers.
         4) Sprinklers.
         5) Access panels.
      e. Perimeter moldings.

D. Maintenance Data: Manufacturer data for finishes for inclusion in maintenance manuals.

E. Submit one copy of ICC-ES Reports.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code:
      a. Comply with applicable requirements of the California Building Code (CBC) for interior finishes:
         1) DSA Interpretation of Regulations – IR 25-2.13 Metal Suspension Systems for Lay-in Panel Ceilings.
         2) 2022 California Building Code.

3) Chapter 19, 2022 California Building Code.
4) Chapter 23, 2022 California Building Code.
5) Acoustical Panel Standard: ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance:
a) Mounting Method for Measuring NRC: Plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E795.

2. Surface Burning Characteristics:
a. Ceiling panels with surface burning characteristics complying with CBC and ASTM E1264 for Class A materials determined by testing identical products in accordance with ASTM E84:
1) Flame Spread Index: 25 or less.
2) Smoke Developed Index: 450 or less.
3. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE 7.
4. Fire Resistance Ratings: Comply with ASTM E119; testing by qualified testing agency. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory* or from the listings of another qualified testing agency.

B. Source Limitations:
1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Comply with applicable regulations regarding toxic and hazardous materials:
1. Coating Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
2. Panel Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the panels.

D. Pre-installation Conference: Conduct conference at site.

1.5 WARRANTY

A. Standard Ceiling Panels: Warrant ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of one (1) year from the date of Substantial Completion.

B. Sag Resistant Ceiling Panels: warrant products to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of ten (10) years from the date of Substantial Completion.

C. Standard Suspension System: Suspension systems shall be warranted to be free from defects in material or factory workmanship and shall not incur 50 percent red rust as defined by ASTM B117 test procedures for a period of ten (10) years from the date of Substantial Completion.

D. Suspension system / ceiling panels: Provide manufacturers standard 15 year warranty for suspension systems when used in combination with same manufacturers sag resistant ceiling panels. Ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects. Suspension systems shall not incur 50 percent red rust as defined by ASTM B117 test during the period of the warranty, extra materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to site in original, unopened packages and store in a fully enclosed, conditioned space protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, allow panels to attain room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide ceiling panels and grid systems by one of the following:
   1. Concealed and Exposed Suspension Grid:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corporation.
      c. Chicago Metallic; Rockfon (Roxul Inc.).
      d. Hunter Douglas.
      e. USG Interiors.
   2. Acoustical Ceiling Panel:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corporation.
      c. Rockfon (Roxul Inc.).
      d. Tectum Inc.
      e. USG Interiors.
   3. Molding and Edge Trim:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corp.
      c. Chicago Metallic Corporation.
      d. Fry Reglet Corporation.
      e. Gordon, Inc.
      f. USG Interiors, Inc.; Subsidiary of USG Corporation.
   4. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation; SHEETROCK Acoustical Sealant.
   5. Acoustical Sealant for Concealed Joints:
      a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
      b. Pecora Corporation; AIS-919.

B. Acoustical Panel Colors and Patterns:
   1. Match appearance characteristics indicated for each product type:
      a. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 METAL SUSPENSION SYSTEM

A. Metal Suspension System:

1. Direct hung metal suspension systems of types, structural classifications, and finishes indicated complying with applicable requirements in ASTM C635/C635M:
   a. High Humidity Finish:
      1) Comply with ASTM C635/C635M requirements for Coating Classification for Severe Environment Performance where high humidity finishes are indicated.
   b. Attachment Devices - Size for five times the design load indicated in ASTM C635/C635M, Table 1 Direct Hung, unless otherwise indicated. Comply with seismic design requirements:
      1) Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488 or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency:
         a) Type: Cast in place, postinstalled expansion or postinstalled bonded anchors.
         b) Corrosion Protection: Carbon steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
         c) Corrosion Protection: Stainless steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
         d) Corrosion Protection: Components fabricated from nickel copper alloy rods complying with ASTM B164 for UNS No. N04400 alloy.
      2) Power Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
2. Wire Hangers, Braces, and Ties:
   a. Zinc Coated, Carbon Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   b. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
   c. Nickel Copper Alloy Wire: ASTM B164, nickel copper alloy UNS No. N04400.
   d. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1 Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 inch (2.69 mm) diameter wire.
3. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust inhibitive paint.
4. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04 inch (1 mm) thick, galvanized steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16 inch (8 mm) diameter bolts.
5. Hold Down Clips: Provide hold down clips spaced 24 inches (610 mm) o.c. on all cross tees in areas with exterior opening larger than 48” x 96”.
6. Impact Clips: Provide impact clip system designed to absorb impact forces against acoustical panels in Gymnasiums.
7. Aluminum cap for use over steel grid in kitchen areas or where shown on drawings or required.

B. Metal Suspension Systems:
   1. Wide Face, Steel Capped, Double Web, Steel Suspension System:
      a. Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished 15/16 inch (24 mm)

wide metal caps on flanges:
1) Structural Classification: Heavy duty system.
2) Face Design: Flat, flush.
3) Cap Finish: Color selected by Architect.

2. Narrow Face, Steel Capped, Double Web, Steel Suspension System:
   a. Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished, cold rolled, 9/16 inch (15 mm) wide metal caps on flanges:
      1) Structural Classification: Intermediate-duty system.
      2) Face Design: Flat, flush.
      3) Cap Finish: Color selected by Architect.

2.3 ACOUSTICAL PANELS

A. Acoustic Panel Type I:
1. Basis of Design Product: School Zone Fine Fissured No. 1713 by Armstrong World Industries.
2. Classification - Provide panels complying with ASTM E1264 for type, form, and pattern:
   a. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
   b. Pattern: CE (perforated, small holes and lightly textured).
3. Color: White.
4. LR: Not less than 0.85.
5. NRC: Not less than 0.70.
6. CAC: Not less than **35**.
7. Edge/Joint Detail: Square.
8. Thickness: 3/4 inch (19 mm).
9. Modular Size: 24 by 24 inches (610 by 610 mm).
10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.
11. Typical Location: Primary learning areas and classrooms.

B. Acoustic Panel Type II:
1. Basis of Design Product: Painted Nubby Open Plan No. 3102 by Armstrong World Industries.
2. Classification - Provide panels complying with ASTM E1264 for type, form, and pattern:
   a. Type and Form: Type XII, glass fiber base with membrane faced overlay; Form 2, cloth.
   b. Pattern: E (lightly textured).
   c. Color: White.
3. LR: Not less than 0.84.
4. NRC: Not less than 0.95.
5. Edge/Joint Detail: Square.
6. Thickness: 1 inch (25 mm).
7. Modular Size: 24 by 24 inches (610 by 610 mm).
8. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.
9. Typical Location: Music rooms, performing arts rooms.

C. Acoustic Panel Type III:

1. Basis of Design Product: Clean Room VL No. 868 by Armstrong World Industries.
2. Classification - Provide [fire resistance rated] panels complying with ASTM E1264 for type, form, and pattern:
   a. Type and Form: Type IV, mineral base with membrane faced overlay; washable vinyl film overlay.
   b. Pattern: GH (smooth and printed).
   c. Color: White.
3. LR: Not less than 0.80.
4. CAC: Not less than 40.
5. Edge/Joint Detail: Square.
6. Thickness: 5/8 inch (15 mm).
7. Modular Size: 24 by 24 inches (610 by 610 mm).
8. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.
9. Typical Location: Food preparation areas.

2.4 MOLDING, TRIM AND ACCESSORIES

A. Shadow Molding: Where an acoustical lay in ceiling abuts a gypsum board ceiling in the same plane, provide a "W" shaped reveal or "shadow" molding similar to Armstrong Shadow Molding No. 7873.

B. Light Fixture Protection:
   1. Manufacturer: Thermafiber Light Protection Kit by Owens Corning or Type 5/8 or 3/4 P(S) by Armstrong World Industries.
   2. Fire Resistance Rating: Same as ceiling assembly rating.
   3. Locations: At fixtures reinstalled in fire rated ceiling assemblies.

C. Roll Formed, Sheet Metal Edge Moldings and Trim:
   1. Type and profile for standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color used for exposed flanges of suspension system runners:
      a. Provide edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
      b. For lay in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
      c. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

D. Extruded Aluminum Edge Moldings and Trim:
   1. Where indicated, provide extruded aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
      a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B221 for Alloy and Temper 6063-T5.
      b. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
      c. Baked Enamel or Powder Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written

instructions for cleaning, conversion coating, and applying and baking finish.

E. Acoustical Sealant:
1. Comply with ASTM C834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
   a. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
   b. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations:
1. Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use:
   a. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

3.2 EXTRA MATERIALS

A. Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents:
1. Acoustical Ceiling Panels: Full size panels equal to 2 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold Down Clips: Equal to 2 percent of quantity installed.
4. Impact Clips: Equal to 2 percent of quantity installed.

3.3 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut for compliance with requirements specified that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less than half width panels at borders, and comply with layout shown on reflected ceiling plans.

3.5 INSTALLATION

A. Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA *Ceiling Systems Handbook*:

1. Fire Rated Assembly: Install fire-rated ceiling systems according to tested fire rated design.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers where required and, if permitted with fire resistance rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast in place hanger inserts, postinstalled mechanical or adhesive anchors, or power actuated fasteners that extend through forms into concrete.
   7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   8. Do not attach hangers to steel deck tabs.
   9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
   11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast in place or postinstalled anchors.

D. Panel Accessibility: Install panels downward accessible by disengaging hinge support rail on one side of panel from the T Bar Flange or optional A Mount rail flange without the use of tools, for access without removal of panel from the ceiling.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels:
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit:
   1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
   2. For square edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   3. For reveal edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   4. For reveal edged panels on suspension system members with box shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
   5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
   6. Install hold-down clips in areas indicated, in areas with exterior opening larger than 48” x 96”, where required by authorities having jurisdiction, and for fire resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
   7. Install clean room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
   8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire resistance rated assembly.

3.6 FIRE RATING SCHEDULE

A. Refer to UL Assemblies Drawings for Fire Rating requirements of ceiling materials at rated floor and roof assemblies.

3.7 FIELD QUALITY CONTROL

A. Special Inspections:
   1. Engage a qualified special inspector to perform the following special inspections:
      a. Compliance of seismic design.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements:
   1. Extent of Each Test Area:
      a. When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed:
         1) Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
         2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 00

SECTION 09 65 13.13 RESILIENT BASE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Rubber base.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product including manufacturer's installation instructions.

B. Samples: Sample of Base Selected or Color Chart if none selected.

C. Maintenance Data: Submit for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Entity having minimum 5 years documented experience who employs workers competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store base and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design Product:
   1. Manufacturers and tile series, pattern, and color selections are indicated in the Finish Schedule and are a basis of design. Subject to compliance with requirements, provide product indicated in Finish Schedule or comparable product by one of the following:
      a. Flexco Floors.
      b. Johnsite, a division of Tarkett Group.
      c. Mannington Commercial.
      d. Roppe.

B. Rubber Base - ASTM F1861:
   1. Material: Rubber, vulcanized, Type TS, Group I, Styles A and B.
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. Style: Topset cove; minimum 100 foot coil, cut to length required.

4. Minimum Thickness: 0.125 inch (3.2 mm).
5. Color: Selected by Architect.
6. Height: 4 inches, unless otherwise indicated on drawings.
7. Outside Corners: Job formed.
8. Inside Corners: Job formed.

C. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).

C. Close spaces to traffic for 48 hours after installation.

3.2 EXAMINATION

A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work:
1. Verify that finishes of substrates comply with tolerances and other requirements specified for other work and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.3 PREPARATION

A. Immediately before installation, sweep clean substrates to be covered by resilient base.

3.4 INSTALLATION

A. Comply with manufacturer's written instructions for installing flooring. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Extend flooring into toe spaces, door reveals, closets, and similar openings.

B. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

C. Resilient Base:
1. Comply with manufacturer's written instructions for installing resilient base. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and

other permanent fixtures in rooms and areas where base is required:

a. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
b. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
c. Do not stretch resilient base during installation.
d. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
e. Preformed Corners: Install preformed corners before installing straight pieces.
f. Job Formed Corners:
    1) Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    2) Form without producing discoloration (whitening) at bends.
    3) Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length:
        a) Miter or cope corners to minimize open joints.

END OF SECTION 09 65 13.13

SECTION 09 65 43 LINOLEUM FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Resilient tile flooring adhesive attached with accessories in locations shown on drawings.
   2. Adhesive attached in locations shown on drawings.

B. Related Sections:
   1. Section 09 65 13: Resilient Base.

C. Reference Standards:
   1. ASTM International (ASTM):
      a. E648 - Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source.
      b. E662 - Test Method for Specific Density of Optical Density of Smoke Generated by Solid Materials.
      c. F970 - Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
      d. F1861 - Standard Specification for Resilient Wall Base.
      e. F1869 - Standard Test Method for Determining the Insulation Resistance of a Membrane Switch.

1.3 DEFINITIONS

A. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Samples:
   1. Actual samples or color charts showing manufacturer’s full range of colors for Architect’s selection.
   2. Full tile in each color selected and 12 inch long piece of base material in each color selected for approval.

C. Certification: Manufacturer’s affidavit that materials used in the Project contain no asbestos.

D. Testing Data: Results of floor testing per ASTM F2170: Standard Test Method for

Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer having minimum of five (5) years of experience in performing work of this section who has specialized in installation of work similar to that required for this project. Installer must be Certified by the Manufacturer and provide valid certification before start of the project. The Certified Installer must manage and be on site during installation at all times.

B. Regulatory Requirements:
   1. Fire Performance Characteristics:
      a. Provide resilient linoleum tile flooring with the following fire performance characteristics as determined by testing products in accordance with ASTM method indicated below by a certified testing laboratory or another testing and inspecting agency acceptable to authorities having jurisdiction:
         1) Critical Radiant Flux: Class 1 Rating per NFPA 253 (ASTM E648) (0.45 watts/cm² or greater).
         2) Smoke Density: Less than 450 per ASTM E662.

C. Accessibility Requirements - Comply with applicable requirements:
   1. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
      a. CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
   2. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
   3. 2010 ADA regulations.

D. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products. Contractor shall provide certified moisture testing results per ASTM F2170 (*Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*) to Architect and Owner prior to floor installation. Acceptable moisture content of concrete sub floor shall be within approved manufacture limits or lower prior to installation.

E. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer.

F. Approved installation methods:
   1. Obtain Owner's and Architect's acceptance of finish color, texture and pattern, and workmanship standard. Comply with Section 01 40 00: Quality Requirements (Mock-Up Requirements) Section:
      a. Mock-Up Size: 48 inch by 48 inch
      b. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
      c. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

1.6 WARRANTY

A. Warrant the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to:
   1. Delamination from substrate.
   2. Deterioration or fading

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers named first are basis of Specification. Manufacturers listed, whose product meets or exceeds the specifications are approved for use on the Project with Architect's approval. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 MATERIALS - ALL MATERIALS MUST BE ASBESTOS FREE

A. Linoleum Tile:
   1. Description: Homogeneous tile of primarily natural materials consisting of linseed oil, wood flour, and rosin binders, wood flour, and limestone, mixed and calendared onto a polyester backing. Pattern and color shall extend throughout total thickness of tile material.
   2. Size: 13.11 inch (33.3 cm) by 13.11 inch (33.3 cm).
   3. Gauge: 0.080" inch (2.0mm).
   4. Backing: Polyester backing.
   5. Slip Resistance: Meet or exceed >0.5 for flat surfaces when tested against ASTM D2047.
   6. Manufacturer's protective topcoat finish.
   7. Patterns and Colors: As selected by Architect from full line of colors.
   8. Approved Products/Manufacturers: Specifications are based on **MCT by Forbo** or comparable product.

B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

C. Cement-based Floor Leveling Material: ARDEX K-15 Self-Leveling Underlayment Concrete manufactured by Ardex Engineered Cements, Aliquippa, PA; (724) 203-5000; or CX Self-Leveling Underlayment manufactured by BASF Maserweld 941; Koster SL Self Leveling Underlayment, Virginia Beach, VA 757-425-1206; or equal. Gypsum-based products are prohibited. Level flush with adjacent floor finish.

D. Joining and Edge Finish Moldings:
   1. For use at flooring terminations with other flooring:
      a. Type: Tapered or bullnose edge, as required to provide juncture at edge of adjacent floor surfaces.
      b. Size: One (1) inch wide by 1/8 inch thick or as applicable to the type of flooring and condition.
      c. Material: Rubber or vinyl as recommended by flooring manufacturer to suit application.
      d. Color(s): As selected by Architect from manufacturer's available colors.
      e. Approved Manufacturers: Flexco, Johnsonite, Tarkett, or Architect approved equal.

E. Adhesive:
   1. Tile: Clear set type adhesive; same brand as tile or as instructed and approved by tile manufacturer to suit application. Provide adhesive to support up to 95% internal

relative humidity as determined by testing per ASTM F2170.

F. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation.

2.3 EXTRA STOCK

A. Deliver to the Owner:
1. Four (4) percent or one (1) unopened carton of each color and pattern of tile selected, whichever is greater.
2. Four (4) percent or one (1) unopened carton of each color, type, and size base selected, whichever is greater.
3. One (1) gallon container of each type adhesive used for flooring and base.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment:
1. Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces:
a. Basis-of-Design Product: Subject to compliance with requirements, provide Moxie International Inc.; Moxie Shield 1500 Concrete Sealer or Moxie Shield MFSII Flooring Sealer, P.O. Box 838 Loomis, CA 95650; Contact Manufacturer’s representative: P:916-251-0825, F: 877-330-1930 Email: info@moxieshield.com
b. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Prepare concrete floors to receive flooring in accordance with ASTM F710, and in accordance with manufacturers written instructions.

B. Verify substrates are smooth, level, at required finish elevation, and without more than 1/8 inch in 10 feet-0 inch variation from level or slopes shown on the drawings.

C. Level substrates by grinding high spots or filling low spots with latex cementitious subfloor filler as required.

D. Broom clean or vacuum the surfaces to be covered, and inspect the substrates.

E. Verify substrates are smooth, level, at required finish elevation, and are ready to receive flooring

F. General Contractor and floor subcontractor to ensure a floor moisture test is performed. Moisture tests results are to be submitted to Owner, Architect, and manufacturer’s rep prior to installation. Conduct moisture test in accordance with ASTM F2170 - maximum allowable

amount of moisture internal slab relative humidity is 95%, and shall not exceed maximum allowable moisture content as allowed by flooring manufacturer.

G. Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.

H. Bring discrepancies to the attention of the Architect and do not proceed until such discrepancies are corrected. Starting Work indicates acceptance of existing conditions.

3.3 INSTALLATION

A. General:
1. Install materials only after finishing operations, including painting, have been completed and after permanent heating and cooling system is operating.
2. Verify that moisture content and pH of concrete slabs, building air temperature, and relative humidity are within the limits recommended by the manufacturers of the materials used.

B. Installing Flooring:
1. Place units using full spread of adhesive cement in compliance with the manufacturer's written instructions:
   a. Butt units tightly to vertical surfaces, nosings, edgings, and thresholds.
   b. Scribe as necessary around obstructions and to produce neat joints.
   c. Place tiles tightly laid, even, and in straight parallel lines.
   d. Extend units into toe spaces, door reveals, and in closets and similar spaces.
   e. Do not lay tiles over expansion joints.
2. Lay units from center marks established with principal walls, discounting minor offsets, so that units at opposite edges of the room are of equal width:
   a. Adjust as necessary to avoid use of cut widths less than 3 inches wide at edge of space.
   b. Lay units square to axes of the room or space.
3. Match units for color and pattern by using materials from cartons in the same sequence as manufactured and packaged.
4. Place joining and edge finish moldings, including reducer strips tightly butted to units and secured with adhesive, providing at all unprotected edges unless otherwise shown.
5. Rout out seams and heat weld together with complementary colored heat welding rod in accordance with flooring manufacturer's instructions.

3.4 CLEANING AND PROTECTING

A. Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

END OF SECTION 09 65 43

SECTION 09 68 00 - CARPETING

PART 1 GENERAL

1. RELATED DOCUMENTS

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

2. SUMMARY

Section Includes: Requirements including but not limited to:

1) Carpet and pad.
2) Accessories necessary for a complete installation.

3. SUBMITTALS

Product Data: Technical data including installation recommendations for each type of substrate:

1) Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

Samples: For each products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

2) Carpet: 12 inch (300 mm) square Sample from approved color and product of carpet.
3) Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.
4) Carpet Seam: 6 inch (150 mm) Sample.
5) Mitered Carpet Border Seam: 12 inch (300 mm) square Sample. Show carpet pattern alignment.
6) Carpet base and accessory samples.

Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.

Shop Drawings: Showing extent of product, seam direction, and location and type of carpet accessories. Submittal to indicate columns, doorways, enclosing walls or partitions, casework, and locations where cutouts are required.

Maintenance Data: For carpet to include in maintenance manuals. Include the following:

7) Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
8) Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

4. QUALITY ASSURANCE

1) Fire Test Response Characteristics: Provide products with the critical radiant flux classification determined by testing identical products in accordance with ASTM E 648. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
2) Accessibility Requirements: Comply with applicable requirements.
    a) Americans with Disabilities Act of 1990, as amended.
        1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design
    b) CBC 2016 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).

1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

3) AQMD - Air Quality Management District, Local Regulations.
4) SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.
5) CRI – Carpet and Rug Institute Green Label Plus.
6) Carpet shall have level loop, textured loop, or level-cut/uncut pile texture, firm cushion, pad or backing (or no cushion or pad) and maximum pile height of 1/2 inch in accordance with CBC Section 11B-302.2. Carpet edges shall comply with CBC 11B-302.2 and carpet trim to CBC Section 11B-303.

Installer Qualifications: Installer having minimum 5 years documented experience as a commercial carpet installer, who is certified by the International Certified Floorcovering Installers Association at the Commercial II or higher certification level.

Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

5. DELIVERY, STORAGE, AND HANDLING

Comply with CRI 104.

Store in a dry location between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally, elevated above slab level on a flat surface, stacked no higher than two rolls.

Store materials in area of installation for minimum period of 48 hours prior to installation.

Protect carpet from damage, dirt, stains, and moisture.

6. FIELD CONDITIONS

Comply with CRI 104 for temperature, humidity, and ventilation limitations.

Environmental Limitations: Do not deliver or install carpet and carpet cushion until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

7. WARRANTY

Carpet: Written warranty in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
1) Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2) Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excessive surface wear, excess static discharge, and delamination.

3) Warranty Period: 25 years from date of Substantial Completion.

8. PRE-INSTALLATION CONFERENCE

Refer to Section 01 31 19 – Project Meetings.

PART 2 PRODUCTS

1. MATERIALS

Basis of Design: Carpet series and patterns indicated on Finish Schedule. Subject to compliance with requirements, provide products by one of the following;
1) Tandus-Centiva
2) Or approved equal.

Rubber Base: As specified in Section 09 65 20.

Carpet:
3) Performance:
   a) Appearance Retention Rating: Severe traffic, 3.5 minimum according to ASTM D 7330.
   b) Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
   c) Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
   d) Delamination: Not less than 4 lbf/in. (18 N/mm) per ASTM D 3936.
   e) Tuft Bind: Not less than 5 lbf (22 N) according to ASTM D 1335.
   f) Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
   g) Resistance to Insects: Comply with AATCC 24.
   h) Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
   i) Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
   j) Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
   k) Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
   l) Emissions: Provide carpet that complies with testing and product requirements of CRI Green Label Plus.
   m) Backing: Standard with manufacturer.
4) Face Construction:
   a) Width: Six (6) feet.
   b) Construction: Level Loop.
   c) Gauge: 1/13.
   d) Pile Units per Inch: 8.2.
   e) Pile Height Average: 0.117 inch.
   f) Tuft Density: 104.96.
   g) Cushion Roll Goods (RS), Total Weight: 81.0 ounces per square yard.
   h) Fiber Content: TDX Nylon Type 6,6.
   i) Dye Method: 50% Solution Dyed/50% Yarn Dyed.
5) Basis of Design: Powerbond Cushion Backing System by Tandus.
   a) Primary Tufting Substrate: Synthetic nonwoven.
   b) Fusion Coat: Sealant Vinyl.
   c) Backing: Closed-Cell Vinyl Cushion
      1) Weight: 35.5 ounces per square yard.
      2) Density: 18.5 lbs. per cubic foot.
      3) Thickness: 5/32 inch.
      4) Compression Set: Maximum 10 percent.

5) Compression Deflection:
   a) Maximum 7 lbs. per square inch at 25 percent.
   b) Maximum 25 lbs. per square inch at 25 percent.

d) Adhesive System: Microencapsulated Tackfier applied to 100 percent during manufacturing.

6) Total Product Weight: RS 83.0 ounces per square yard plus or minus 5 percent. Product Testing Information:
   a) Surface Flammability: Passes CPSC FF-1-70. (ASTM D2859)
   b) Flooring Radiant Panel: Class 1 (mean average CRF: 0.45 watts per square centimeter or higher. (ASTM E648)
   c) Electrostatic Propensity: 3.0 kV or lower. Permanent Conductive Fiber. (AATCC 134)
   d) Color(s): As indicated on drawings.
   e) Locations: Indicated on drawings.
7) Style: Abrasive Action II manufactured by Tandus Commercial Floor Systems.

Entry Mat System:
8) Basis of Design Product/Manufacturer: “Abrasive Action” as manufactured by Tandus (Collins and Aikman) Commercial Floor Systems, Dalton GA; (404) 259-9711.
9) Type: Patterned carpet tiles.
10) Construction: Accuweave patterned Loop
11) Color: Charcoal
12) Locations: As shown on drawings.

Applied Soil Resistance Treatment: Standard with manufacturer.

Antimicrobial Treatment: Standard with manufacturer.

Adhesives: Water resistant, mildew resistant, nonstaining, pressure sensitive type to suit products and subfloor conditions indicated, complying with flammability requirements for installed carpet and is recommended by carpet manufacturer for releasable installation.

Trowelable Leveling and Patching Compounds: Latex modified, hydraulic cement based formulation provided or recommended by carpet cushion manufacturer.

Adhesives: Water resistant, mildew resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

Seam Adhesive: Hot melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

Extra Carpet: After completion of the carpet installation, the carpet subcontractor shall provide an additional three (3) percent of total yards installed of each carpet specified to the Owner for future carpet replacement that may be required. This extra stock is to be unused rolls, tiles, and mats and does not include scraps.

PART 3 EXECUTION

1. EXAMINATION

Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1) Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
2) Prior to delivery of flooring materials, contractor shall conduct Calcium Chloride “dome” test to verify that concrete floors are dry with maximum moisture vapor emissions of 3 lbs. per 1000 square feet. in 24 hours, and exhibit negative alkalinity, carbonation or dusting. Apply moisture test in four (4) different areas of each floor location with at least one test for each 1,000 square feet of floor area.
3) Prior to delivery of carpeting, conduct Relative Humidity Test Method in accordance with ASTM F 2170 using a Wagner Rapid RH probe to verify relative humidity and surface pH of concrete floor slabs, the method:
    a) Requires drilling holes at diameter not to exceed outside diameter of probe by more than 0.04 inch to depth equal to 40 percent of slab's thickness (elevated structural slab shall be tested at depth equal to 20 percent of slab thickness).
    b) Place probe to full depth of test hole, place cap over probe.
    c) Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
    d) Remove cap and press button on the probe to obtain reading.
    e) Relative humidity readings for substrates receiving non-permeable flooring are 75% or lower.
4) Testing shall require 3 tests in first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface.
5) Alkalinity Testing: Concrete floors shall be tested for alkalinity prior to installation of flooring. Levels of pH shall not exceed written recommendations of flooring manufacturer or adhesive manufacturer, or both.
6) Delivery of flooring materials and beginning of installation means acceptance of existing substrate and site conditions.
7) Subfloor finishes comply with requirements specified in Section 03 30 00 Cast-In-Place Concrete for slabs receiving carpet.
8) Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
9) Install Vapor Emission Treatment Systems where tests reveal presence of more than acceptable moisture level in accordance with Test Method ASTM F 1869 or ASTM F 2170.

Proceed with installation after correcting unsatisfactory conditions.

2. PREPARATION

Comply with CRI 104, Section 7.3 *Site Conditions; Floor Preparation* and with carpet manufacturer's written installation instructions for preparing substrates.

Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet and cushion manufacturer.

Broom and vacuum clean substrates to be covered immediately before installing carpet.

3. INSTALLATION

Comply with CRI 104 and carpet and carpet cushion manufacturer written installation instructions for the following:

1) Direct Glue Down Installation: Comply with CRI 104, Section 9 *Direct Glue Down Installation*.

Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

2) Do not bridge building expansion joints with carpet.
3) Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
4) Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

Install pattern parallel to walls and borders to comply with CRI 104, Section 15, *Patterned Carpet Installations* and with carpet manufacturer's written recommendations.

Install in accordance with CBC Section 11B-302.2.

5) Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion pad. It shall have a level loop, level cut pile, or level cut/uncut pile texture. Pile height shall be ½" maximum.
6) Exposed edges shall be fastened to floor surfaces and shall have trim on the entire length. Carpet edges shall comply with CBC Section 11B-303.

4. CLEANING AND PROTECTING

Perform cleaning operations immediately after installing carpet:

1) Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2) Remove yarns that protrude from carpet surface.
3) Vacuum carpet using commercial machine with face beater element.

Protect installed carpet to comply with CRI 104, Section 16, *Protecting Indoor Installations*.

Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer.

END OF SECTION 09 68 00

SECTION 09 68 01 CARPETING WALK-OFF-MATS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Walk Off Carpet.
   2. Accessories necessary for a complete installation.

B. Related Sections;
   1. Section 03 30 00: Cast-in-Place Concrete.
   2. Section 09 68 00: Carpeting.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data including installation recommendations for each type of substrate:
      a. Carpet:
         1) For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Samples:
   1. For each products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules:
      a. Carpet: 12 inch (300 mm) square Sample from approved color and product of carpet.
      b. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.
      c. Mitered Carpet Border Seam: 12 inch (300 mm) square Sample. Show carpet pattern alignment.
      d. Carpet base and accessory samples.

C. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.

D. Shop Drawings: Showing extent of product, seam direction, and location and type of carpet accessories. Submittal to indicate columns, doorways, enclosing walls or partitions, casework, and locations where cutouts are required.

E. Maintenance Data:
   1. For carpet to include in maintenance manuals. Include the following:
      a. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
      b. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Test Response Characteristics:
      a. Provide products with the critical radiant flux classification determined by testing identical products in accordance with ASTM E648:
         1) Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
   2. Accessibility Requirements:
      a. Comply with applicable requirements:
         1) Americans with Disabilities Act of 1990, as amended:
            a) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
            b) 2010 ADA regulations.
         2) 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA):
            a) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
   3. AQMD - Air Quality Management District, Local Regulations.
   4. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.
   5. CRI – Carpet and Rug Institute Green Label Plus.
   6. Carpet shall have level loop, textured loop, or level-cut/uncutpile texture, firm cushion, pad or backing (or no cushion or pad) and maximum pile height of 1/2 inch in accordance with CBC Section 11B-302.2. Carpet edges shall comply with CBC 11B-302.2 and carpet trim to CBC Section 11B-303.

B. Installer Qualifications: Installer having minimum 5 years documented experience as a commercial carpet installer, who is certified by the International Certified Floorcovering Installers Association at the Commercial II or higher certification level.

C. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

D. Pre-installation Conference:
   1. Pre-Installation conference to be conducted at project site.

1.5 WARRANTY

A. Written warranty in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period:
   1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excessive surface wear, excess static discharge, and delamination.
   3. Warranty Period: 25 years from date of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

B. Store in a dry location between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally, elevated above slab level on a flat surface, stacked no higher than two rolls.

C. Store materials in area of installation for minimum period of 48 hours prior to installation.

D. Protect carpet from damage, dirt, stains, and moisture.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design:
   1. Carpet series and patterns indicated on Finish Schedule. Subject to compliance with requirements, provide products by one of the following:
      a. Tandus-Centiva.
      b. Mannington Mills.
      c. Mohawk Croup.
      d. Patcraft.
      e. Shaw Contract Group.

B. Carpet (Walk-Off):
   1. Type: Patterned carpet tiles.
   2. Construction: Accuweave® Patterned Loop
   3. Color(s): Kaleidoscope 55021.
   4. Locations: As shown on Drawings.
   5. Approved Product/Manufacturer: “Abrasive Action” as manufactured by Tandus (Collins and Aikman) Commercial Floor Systems, Dalton GA; (404) 259-9711.

C. Applied Soil Resistance Treatment: Standard with manufacturer.

D. Antimicrobial Treatment: Standard with manufacturer.

E. Adhesives: Water resistant, mildew resistant, nonstaining, pressure sensitive type to suit products and subfloor conditions indicated, complying with flammability requirements for installed carpet and is recommended by carpet manufacturer for releasable installation.

F. Trowelable Leveling and Patching Compounds: Latex modified, hydraulic cement based formulation provided or recommended by carpet cushion manufacturer.

G. Adhesives: Water resistant, mildew resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

H. Extra Carpet: After completion of the carpet installation, the carpet subcontractor shall provide an additional three (3) percent of total yards installed of each carpet specified to the Owner for future carpet replacement that may be required. This extra stock is to be unused rolls, tiles, and mats and does not include scraps.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet and carpet cushion until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors:
   1. Verify that concrete slabs comply with ASTM F710 and the following:
      a. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
      b. Prior to delivery of flooring materials, contractor shall conduct Calcium Chloride “dome” test to verify that concrete floors are dry with maximum moisture vapor emissions of 3 lbs. per 1000 square feet. in 24 hours, and exhibit negative alkalinity, carbonation or dusting. Apply moisture test in four (4) different areas of each floor location with at least one test for each 1,000 square feet of floor area.
      c. Prior to delivery of carpeting, conduct Relative Humidity Test Method in accordance with ASTM F2170 using a Wagner Rapid RH probe to verify relative humidity and surface pH of concrete floor slabs, the method:
         1) Requires drilling holes at diameter not to exceed outside diameter of probe by more than 0.04 inch to depth equal to 40 percent of slab's thickness (elevated structural slab shall be tested at depth equal to 20 percent of slab thickness).
         2) Place probe to full depth of test hole, place cap over probe.
         3) Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
         4) Remove cap and press button on the probe to obtain reading.
         5) Relative humidity readings for substrates receiving non-permeable flooring are 75% or lower.
      d. Testing shall require 3 tests in first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface.
      e. Alkalinity Testing: Concrete floors shall be tested for alkalinity prior to installation of flooring. Levels of pH shall not exceed written recommendations of flooring manufacturer or adhesive manufacturer, or both.
      f. Delivery of flooring materials and beginning of installation means acceptance of existing substrate and site conditions.
      g. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
      h. Install Vapor Emission Treatment Systems where tests reveal presence of more than acceptable moisture level in accordance with Test Method ASTM F1869 or ASTM F2170.

C. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Comply with CRI 104, Section 7.3 *Site Conditions; Floor Preparation* and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level

cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet and cushion manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.4 INSTALLATION

A. Comply with CRI 104 and carpet and carpet cushion manufacturer written installation instructions for the following:
   1. Direct Glue Down Installation: Comply with CRI 104, Section 9 *Direct Glue Down Installation*.
   2. Stair Installation: Comply with CRI 104, Section 13 *Carpet on Stairs* for glue down installation.

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position:
   1. Do not bridge building expansion joints with carpet.
   2. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
   3. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

D. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, *Patterned Carpet Installations* and with carpet manufacturer's written recommendations.

E. Install in accordance with CBC Section 11B-302.2

3.5 CLEANING AND PROTECTING

A. Perform cleaning operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, *Protecting Indoor Installations*.

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer.

END OF SECTION 09 68 01

SECTION 09 90 00 PAINTING AND COATING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Surface preparation and field painting of exposed items and surfaces.
   2. Field preparation and painting of factory primed metal products and fabrications.
   3. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D16 apply:
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Satin refers to a slightly higher sheen than eggshell and more reflective and durable finish and is less lustrous than semi-gloss.
   4. Semigloss refers to medium sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   5. Full gloss refers to high sheen finish with a gloss range more than 70 when measured at a 60-degree meter

1.4 SUBMITTALS

A. Product Data:
   1. Submit technical data and information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, and applying each coating material proposed for use:
      a. Indicate manufacturer's instructions for special surface preparation procedures, substrate conditions requiring special attention.
      b. Material List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification.
      c. Submit Zero VOC compliant products only.

B. Samples:
   1. Submit for each type of paint system and in each color and gloss of topcoat:
      a. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
      b. Provide list of material and application for each coat of each sample. Label each sample as to location and application.
      c. Submit samples on following substrates for review of color and texture only:
         1) Concrete: Provide two 4-inch square samples for each color and finish.
         2) Concrete Masonry: Provide two 4" x 8" samples of masonry, with mortar joint

in the center, for each finish and color.

3) Painted Wood: Provide two 12-inch square samples of each color and material on hardboard.
4) Ferrous and Nonferrous Metals: Provide two 4-inch square samples of flat metal and two 8 inch long samples of solid metal for each color and finish.

C. Product List: Submit list of including each paint system, color, and location of application. Use same product and location designations indicated in Finish Schedule.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with Federal and State/Local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to: lead and mercury. Do not use solvents in paint products that contribute to air pollution.
2. Performance and Durability:
a. ASTM D16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
b. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
c. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
d. ASTM D4828 Standard Test Method for Practical Washability of Organic Coatings.

B. Applicator Qualifications: A firm or individual having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.

C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 WARRANTY

A. Written warranty signed by the manufacturer and the installer in which the manufacture and installer agree to repair or replace paint and primers that fail within specified warranty period:
1. Failures include, but are not limited to, the following:
a. Flaking or delamination of paint with the substrate.
b. Rust, scale, similar imperfections due to improper surface preparation.
c. Thinning or watering of paint beyond that considered acceptable of paint manufacturer.
d. Failure to achieve dry film thickness (DFT) recommended by manufacturer for each coat in a paint system.
e. Deterioration or loss of color of paint beyond normal weathering.
2. Warranty Period: One year from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C):
1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design is **Dunn Edwards Corporation p**aints. Subject to compliance with requirements, provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential products are not permitted:
   1. Proprietary Names: Paint Schedule is based on a single manufacturer for convenience. With exception to the paint used in the theater. Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that named products are required to the exclusion of comparable products of specified manufacturers. Furnish product technical data, including per cent solids by weight and volume; VOC content limits and emissions data; and certificates of performance for comparable paint products of specified manufacturer.
   2. Other Acceptable Paint Manufacturers:
      a. Sherwin-Williams Co.
      b. Vista Paint
      c. Benjamin Moore & Co.
      d. Dulux; Theater Black.
   3. Intumescent Paint:
      a. Fire-Retardant paint for use over combustible wood and metal material in Buildings:
         1) FlameOff Coatings, Inc. (Basis of Design) www.flameoffcoatings.com:
            a) No substitution.
   4. Concrete Floors – Sealed (Low Sheen Epoxy Acrylic)
      a. Rust-Oleum, Convenience Products Corp., Vernon Hills, IL. (877) 385-8155
         1) Seal Krete Concrete Sealer
         2) Seal Krete Primer
         3) Seal Krete Epoxy seal and Decorative Flakes.
         4) Seal Krete – Clear Sealer

B. Material Compatibility: Provide each paint system including block fillers, primers, and finish coats, that are compatible with one another and with substrates indicated under conditions of service and application, demonstrated by manufacturer based on testing and field experience.

C. Material Quality: Provide manufacturer's best quality commercial paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint material containers not displaying manufacturer's product identification will not be acceptable. Residential quality paint products are not permitted.

D. Chemical Components of Interior Paints and Coatings:
   1. Provide products complying with limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and SCAQMD Rule1113:
      a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
      b. Restricted Components: Paints and coatings shall not contain components restricted by the EPA and the SCAQMD.
      c. Intumescent Paint - ASTM E84 and ASTM E263 (ASTM E119) for 2 hr. ICC-ES Listed:
         1) Wide Flange Columns: B1077-1.
         2) Tube Columns: B1077.
         3) Pipe Columns: B1077.
         4) Beams: GL-N609.

E. Accessories: Materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

F. Patching Materials: Latex filler compatible with paint systems.

G. Fastener Head Cover Materials: Latex filler.

H. Theater Black: No Exceptions or alternates.

2.2 SOURCE QUALITY CONTROL

A. Testing of Paint Materials:
   1. Owner reserves the right to invoke to engage the services of a qualified testing agency to sample paint materials:
      a. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to site, samples may be taken at the site. Samples will be identified, sealed, and certified by testing agency.
      b. Testing agency will perform tests for compliance with product requirements.
      c. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Apply waterborne paints when temperatures of surfaces to be painted and surrounding air are between 50 degrees F and 90 degrees F (10 degrees and 32 degrees C).

B. Do not thin or add water to waterbased paints, including waterbased alkyds.

C. Weather Conditions:
   1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
   2. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above dew point; or to damp or wet surfaces.
   3. Minimum Application Temperatures for Water based Paints: Between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

D. Apply solvent thinned paints when temperatures of surfaces to be painted and surrounding air are between 45 degrees F and 95 degrees F (7 degrees F and 35 degrees C):
   1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
   2. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

E. Provide lighting level of 80-foot candles (860lx) measured midheight at substrate surface.

F. Labels: Do not paint over Underwriters Laboratories, Factory Mutual, other code required labels, or equipment name, identification, performance rating, or nomenclature plates.

3.2 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents:
   1. Paint: 2 percent, but not less than 1 gallon (3.8 L) of each material and color applied.

3.3 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content and conditions affecting performance of the work.

B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings:
   1. Maximum moisture content of substrates when measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Fiber Cement Board: 12 percent.
      c. Masonry (Clay and CMUs): 12 percent.
      d. Wood: 15 percent.
      e. Gypsum Board: 12 percent.
      f. Plaster: 12 percent.
   2. Test cementitious and plaster cement/stucco for alkalinity (pH).

C. Gypsum Board Substrates: Verify taped joints are tapes and finishing compound is sanded smooth.

D. Plaster Substrates: Verify plaster has fully cured. Verify existing plaster is in good condition and can receive new paint coating.

E. Spray Textured Ceiling Substrates: Verify surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers:
   1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint system consisting of primer and two top coats at a minimum:
      a. Note: Previously painted surfaces have failed to accept new paint systems. Determined cause of failure and take corrective measures to ensure each surface accepts new paint system. Failure of new paint system is not permitted.

G. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator’s acceptance of surfaces and conditions.

3.4 PREPARATION

A. Coordination of Work:
   1. Review work in which primers are provided to ensure compatibility of the total system for various substrates. Notify Architect of anticipated problems when using materials specified over substrates primed by others:
      a. Preprimed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or preprimed substrates.
      b. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify

Architect of anticipated problems.

c. Correct defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
d. Seal marks which may bleed through surface finishes.

B. Surface Preparation:
1. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting:
a. Remove hardware and hardware accessories, plates, lighting fixtures, and similar items that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
b. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection if any.
c. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
d. Clean and prepare surfaces to receive paint according to manufacturer's written instructions for each substrate condition and as specified. Provide barrier coats over incompatible primers, existing paint or coating, or remove and reprime.
e. Correct defects and clean surfaces affecting bond with paint or coating system. Remove existing coatings exhibiting loose surface defects. Seal marks which may bleed through surface finishes.

C. Cleaning:
1. Before applying paint or surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces:
a. Remove incompatible primers, including factory applied primers, and reprime substrate with compatible primers or apply barrier coat as necessary to produce paint systems indicated.
b. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
c. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
d. Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
e. Aluminum Substrates: Remove surface oxidation.

D. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach. If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.

E. Protective Coverings: Provide protections for duration of the work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.

F. Renovated Surfaces:
1. Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system:
   a. Remove surface film preventing proper adhesion and bond.
   b. Wash glossy paint with a solution of sal soda and rinse thoroughly.
   c. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
   d. Clean corroded iron and steel surfaces.
   e. Repair and blend into portland cement plaster.
   f. Prime bare surfaces.
   g. Tone varnished surfaces with stain bringing to uniform color.
   h. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until correcting unsatisfactory conditions.

G. Cementitious Substrates:
1. Prepare concrete surfaces to receive paint. Remove efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation:
   a. Use abrasive blast cleaning methods if recommended by paint manufacturer.
   b. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions:
      1) Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
      2) Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m).
      3) Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
      4) Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
      5) Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.
   c. Clean concrete floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.

H. Ferrous Metals:
1. Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations:
   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC SP6/NACE No. 3.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

d. Review Intumescent paint manufacturer requirements and apply thickness recommended or min per hour rating. See drawings for rated requirements.

I. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

J. Shop Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC PA1 for touching up shop primed surfaces.

K. Aluminum Substrates: Clean surfaces to remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP1 Solvent Cleaning. Lightly abrade surface with a nonmetallic pad.

L. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

M. Plaster/Stucco Substrates:
1. Remove contaminants, release agents, curing compounds, efflorescence, chalk, mold, mildew, and similar deterrents. Spot patch existing plaster to eliminate blisters, buckles, excessive crazing, and to check cracking, dryouts, efflorescence, sweat outs, and similar deflects the prevent plaster from bonding with paint or coatings. Sand or texture repair or patch to match adjacent finish and to remove trowel marks and arises:
   a. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
   b. Deep Cracks: Clean out and fill deep cracks with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
   c. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions. Test for alkali using litmus paper.
   d. Allow patching and repair compounds to set and cure before painting.

N. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

O. Wood Substrates:
1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
2. Sand surfaces that will be exposed to view and dust off.
3. Prime, stain, or seal wood to be painted. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

P. Pipe Covering and Insulation: Clean to remove loose, foreign, and objectionable material before applying sealing coat.

Q. Preparation of Substrates for Wallcovering:

1. Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate:
   a. Assure compatibility with product of wall covering manufacturer.
   b. Fill indentations in substrate and prime with opaque white primer before applying release coat.
   c. Apply release coat in accordance with manufacturer's recommendations.

R. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.

S. Material Preparation:
1. Mix and prepare paint materials according to manufacturer's written instructions:
   a. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   b. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   c. Do not use thinners for water-based paints.
   d. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.5 APPLICATION

A. Comply with manufacturer’s written instructions and recommendations applicable to substrates and paint systems indicated:
1. The term *exposed surfaces* includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
2. Use applicators and techniques suited for paint and substrate indicated.
3. Provide finish coats compatible with primers.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
5. Paint exposed surfaces (top, bottom, sides, edges, underneath). If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces:
   a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
   b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
   c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
8. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
9. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions

detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

10. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
11. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
12. Provide finish coats compatible with primers used.
13. Sand lightly between each succeeding enamel or varnish coat.

B. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

C. Applicators:
1. Apply paints and coatings by brush, roller, spray, or applicators recommended by manufacturer:
   a. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
   b. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool recommended by manufacturer for material and texture required.
   c. Spray Equipment: Use airless spray equipment with orifice size recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness:
1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer:
   a. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.

E. Application:
1. Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration:
   a. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
   b. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
   c. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
   d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

F. Mechanical and Electrical Work:
1. Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces:
   a. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   b. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are

prefinished.

c. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
d. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
e. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
f. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
g. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.

G. Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Painting is limited to items exposed in equipment rooms and occupied spaces:
a. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
b. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
c. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
d. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
e. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
f. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

H. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.

J. Finish Coats:
1. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through:
a. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.

b. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

L. Touch Up:
1. Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated:
   a. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
   b. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
   c. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
   d. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.6 FIELD QUALITY CONTROL

A. Dry Film Thickness (DFT) Testing:
1. Tests for dry film thickness may be determined by using a Tooke Scale and microgroover, an electronic scanner, or the Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness:
   a. Contractor shall touch up and restore painted surfaces damaged by testing.
   b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.7 CLEANING AND PROTECTION

A. It is of the upmost importance to the AISD that the sites remain in a safe, clean, and well-maintained condition. At the end of each day, leave the site ready to use by staff and students. Protect staff and students and the learning environment throughout the work.

B. Cleanup: At the end of each day, remove empty cans, rags, rubbish, and discarded paint materials from the site. After completion of painting work, clean glass, and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide *Wet Paint* signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

E. At completion of painting activities, touch up and restore damaged or defaced painted

surfaces.

F. Waste Management: Legally dispose of unused paint and paint containers in accordance with manufacturer's recommendations and environmental regulations.

PART 4 SCHEDULES

A. The following is a schedule of typical painted items and does not specifically include every item that is to receive paint but should establish type and quality of finish for all items normally included in a complete paint job.

B. Exterior Surfaces (Note: Exterior surfaces are divided into two (2) different categories, based upon color and level of graffiti resistance required. System 1 will be used when standard earthtone colors or neutral colors are specified, and System 2 will be used when bright colors (primary reds, yellows, and oranges) are specified and/or when a graffiti resistant coating is required:

1. Galvanized Metal:
   a. Surface Preparation: Acid etch galvanized surfaces that have not weathered at least six (6) months prior to beginning painting operations. Krud Kutter Metal Clean and Etch.
   b. Primer: One (1) coat ULTRASHIELD Interior/Exterior Galvanized Metal Primer (ULGM00).
   c. Finish: Two (2) coats ENDURACOAT Interior/Exterior Semi-Gloss Industrial Paint (ENCT50).
2. Un-galvanized Metal: As Specified
   a. Primer: One (1) coat Interior/Exterior Acrylic Rust Preventative Metal Primer (ENPR00).
   b. Finish: Two (2) coats ENDURACOAT Interior/Exterior Semi-Gloss Industrial Paint(ENCT50).
3. Concrete and CMU:
   a. Primer/Finish: (2) coats Eff-Stop Premium ESPR00 Masonry Primer /
4. Concrete Floors:
   a. ~~1st Coat~~ Preparation: Seal Krete – Clean-N-Etch.Grind to CPS 2 (120 grit sand paper)
   b. ~~2nd~~ 2-Coats: Seal Krete – Lock Down Primer.
   c. ~~3rd~~ 2-Coats: Seal Krete – Epoxy Seal with Decorative Flakes. Sprinkle Decorative Flakes on floor after 2nd coat
   d. ~~4th~~ 2-Coats: Seal Krete – Clear Sealer.
5. Wood (Includes plywood siding and wooden trim):
   a. Primer: One (1) coat EZ-Prime EZSL00 Exterior Wood Primer. As Specified
   b. Finish: Two (2) coats Spartashield SSHL60 100% Acrylic Gloss. As Specified
6. Fiber-Cement Materials:
   a. Primer: One (1) coat Eff-Stop Premium ESPR00 Masonry Primer. As Specified
   b. Finish: Spartashield SSHL60 100% Acrylic Gloss. As Specified
7. Parking Line and Driveway Paint: Vin-L-Stripe VSZM10 Zone Marking Paint Yellow. As Specified
8. All piping in mechanical rooms shall be painted in their entirety, in the following colors:

   Primer for Carbin Steel - Interior/Exterior Acrylic Rust Preventative Metal Primer (ENPR00)

   a. Aristoshield ASHL70 High-Gloss Enamel:
      1) Gas lines: Orange
      2) Domestic cold water: White
      3) Domestic hot water: Pink
      4) Heating hot water: Red

5) Condenser water: Green
6) Chilled water: Blue

C. Interior Surfaces:
1. Galvanized Metal: As Specified
   a. Primer: One (1) coat Ultrashield Galvanized Metal Primer ULGM00.
   b. Finish: Two (2) coats Aristoshield ASHL50 Semi-Gloss Enamel.
2. Shop-Primed Ferrous Metals (Use for metal doors and frames and miscellaneous metal items): As Specified
   a. Shop coat by others.
   b. One (1) coat over Steel: Bloc-Rust Premium BRPR00 Rust Preventative Primer; Aluminum: Ultrashield Galvanized Metal Primer ULGM00.
   c. Two (2) coats Aristoshield ASHL50 Semi-Gloss Enamel.
3. Gypsum Wallboard: As Specified
   a. Primer: One (1) coat Vinylastic Premium VNPR00 Acrylic Wall Sealer.
   b. Finish: Two (2) coats Spartawall Premium SWLL30 Acrylic Latex Eggshell.
4. Primer Concrete and CMU (Enamel): As Specified
   a. One (1) coat Smooth Blocfil Premium SBPR00 100% Acrylic Block Filler.
   b. Finish: Two (2) coats Premium SWLL50 Acrylic Latex Semi-Gloss.
5. Wood (Painted): As Specified
   a. Primer: DECOPRIME Interior Cabinet, Door and Trim Wood Primer (DCPR00).
   b. Finish: Aristoshield ASHL50 Semi-Gloss Enamel.
6. Wood (Stained): As Specified
   a. Stain: Gemini Craftsman Collection Wiping Stain CCW Water-Based Series.
   b. Finish (First Coat): WB-0230 Gemini Titanium Clear Urethane Satin
   c. Finish (Second Coat): Gemini WB-0230 Gemini Titanium Clear Urethane Satin.
   a. Primer: One (1) coat US Coatings AquaGrip 2600 2-3 Mils DFT.
   b. Finish: One (1) coat US Coatings AquaGrip 2600 3-5 Mils DFT per coat.
   a. Primer: Two (2) coats Smooth Blocfil Premium SBPR00 100% Acrylic Block Filler.
   b. Finish: Two (2) coats US Coatings AquaGrip 2600 3-5 Mils DFT.
   a. Primer: One (1) coat; US Coatings EpoxyGrip 2300 1-2 Mils DFT.
   b. Finish: Two (2) coats bright aluminum paint, US Coatings UreGrip 3000 VOC 2-3 Mils DFT per coat.
7. Intumescent Paint - Steel columns and Beams:
   a. Base white primer. Color paint may be applied:
      1) 1- hour Coat: 30mils typical;
      2) 1- hour Coat: I beams 43 mils.
      3) 1- hour Coat: Pipe Col 97 mils.
      4) 1- hour Coat: Square tube Col 74 mils.
      5) 2-hour Coat: 75mils min. Typical (Mfr calcs: DFT/Volume Solids X 100)
      6) 2-hour Coat: I Beams 71 mils.
      7) 2- hour Coat: WF Col. 177mils.
      8) 2- hour Coat: Pipe Col 202 mils.
      9) 2- hour Coat: Square Tube Col. 207 mils.

D. Paint Types: Refer to the Finish Schedule in the Drawings.

END OF SECTION 09 90 00

SECTION 10 11 00 MARKERBOARD AND TACKBOARD

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
1. Visual display board assemblies.
2. Floor to ceiling visual display assemblies.
3. Rail support systems for visual display board assemblies.
4. Modular support systems for visual display board assemblies.
5. Sliding visual display units.
6. Visual display conference units.
7. Natural slate chalkboards.
8. Glass markerboards.
9. Display rails.
10. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 03 30 00: Cast-In-Place Concrete.
2. Section 06 10 00: Rough Carpentry.
3. Section 09 21 16: Gypsum Board Assemblies.
4. Section 09 90 00: Painting and Coating.

1.3 SUBMITTALS

A. Product Data:
1. Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units:
a. Include electrical characteristics for motorized units.

B. Shop Drawings:
1. Submit plans, elevations, sections, details, and attachment to other work:
a. Indicate sizes and layout, method of attachment, accessories, trim, details and finish.
b. Show locations of panel joints. Show locations of field assembled joints for factory fabricated units too large to ship in one piece.
c. Show locations and layout of special purpose graphics.
d. Include sections of typical trim members.
e. Include wiring diagrams for power and control wiring.

C. Samples:
1. Submit for each type of visual display unit indicated:
a. Visual Display Panel: Not less than 8-1/2 inches by 11 inches (215 mm by 280 mm), with facing, core, and backing indicated for final work. Include one panel for each type, color, and texture required.
b. Trim: 6 inch (150 mm) long sections of each trim profile.
c. Display Rail: 6 inch (150 mm) long section of each type.

d. Modular Support System: 6 inch (152 mm) long sections.
e. Accessories: Full size Sample of each type of accessory.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface burning characteristics of tackboards.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Surface Burning Characteristics:
a. Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
1) Flame Spread Index: 25 or less.
2) Smoke Developed Index: 450 or less.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Accessibility Requirements:
a. Comply with applicable requirements:
1) Americans with Disabilities Act of 1990, as amended:
a) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
2) 2022 California Building Code (CBC) (CCR Title 24, Part 2, as adopted and amended by DSA):
a) CBC Chapter 11B, Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. Installer Qualifications: Entity having minimum 5 years documented experience that employs installers and supervisors who are trained and approved by manufacturer.

C. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

D. Mockups:
1. Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation:
a. Build mockup of typical wall area or visual display unit and floor to ceiling visual display assembly as shown on Drawings. Include accessories and temporary power.
b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
c. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Pre-installation Conference: Conduct conference at site.

1.5 WARRANTY

A. Porcelain Enamel Face Sheets:
1. Written warranty in which Manufacturer agrees to repair or replace porcelain enamel face sheets that fail in materials or workmanship within specified warranty period:
a. Failures include, but are not limited to, the following:
1) Surfaces lose original writing and erasing qualities.
2) Surfaces exhibit crazing, cracking, or flaking.

3) Noticeable deterioration of finish.
4) Writing surface delamination.
5) Fabric discoloration, tearing, or delamination.
6) Unit releasing from substrate.

2. Warranty Period: 5 years from date of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. NACO.

B. Equivalent manufacturers on approval.

2.2 MATERIALS

A. Porcelain Enamel Face Sheet: PEI-1002, with face sheet two or three coat process.

B. High Pressure Plastic Laminate: NEMA LD 3.

C. Natural Cork Sheet: Seamless, single layer, compressed fine grain cork sheet; bulletin board quality; face sanded for natural finish with surface burning characteristics indicated.

D. Plastic Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.

E. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with surface burning characteristics indicated.

F. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd. (508 g/sq. m); with surface-burning characteristics indicated.

G. Hardboard: ANSI A135.4, tempered.

H. Particleboard: ANSI A208.1, Grade M-1.

I. Medium Density Fiberboard: ANSI A208.2, Grade 130.

J. Fiberboard: ASTM C208 cellulosic fiber insulating board.

K. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

L. Extruded Aluminum: ASTM B221, Alloy 6063.

M. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

N. Primer/Sealer: Mildew resistant primer/sealer recommended in writing by visual display unit manufacturer for intended substrate.

2.3 VISUAL DISPLAY BOARD ASSEMBLY

A. Manufacturers:
   1. Subject to compliance with requirements, provide products by one of the following:
      a. ABC School Equipment, Inc.
      b. ADP.
      c. AJW Architectural Products.
      d. Architectural School Products Ltd.
      e. Best-Rite; MooreCo, Inc.
      f. Claridge Products and Equipment, Inc.
      g. Egan Visual Inc.
      h. EverWhite.
      i. Ghent Manufacturing, Inc.
      j. Marsh Industries, Inc.
      k. Nelson Adams, Inc.
      l. Peter Pepper Products, Inc.
      m. Platinum Visual Systems.
      n. Comparable product.

B. Visual Display Board Assembly:
   1. Field or factory fabricated:
      a. Assembly: Chalkboard, markerboard, and tackboard.
      b. Corners: Square.
      c. Width: Indicated on Drawings.
      d. Height: Indicated on Drawings.
      e. Mounting Method: Direct to wall or Modular support system.

C. Chalkboard Panel:
   1. High pressure laminate faced chalkboard panel on core indicated:
      a. Color: Selected by Architect.

D. Markerboard Panel:
   1. Single:
      a. High pressure laminate faced markerboard panel on core indicated:
         1) Color: White
   2. Slider 3- panel and 4 – panel:
      a. High pressure laminated faced markboards on sliders.
      b. Color and Pattern: Selected by Architect.

E. Tackboard Panel:
   1. Vinyl fabric faced tackboard panel on core indicated:
      a. Fabric Wrapped Edge: Wrap edge of tackboard panel with fabric facing.
      b. Color and Pattern: Selected by Architect.

F. Aluminum Frames:
   1. Fabricated from not less than 0.062 inch (1.57 mm) thick, extruded aluminum; slim size and standard shape of size and shape indicated on Drawings:
      a. Field Applied Trim: Snap on trim with no visible screws or exposed joints
      b. Aluminum Finish: Clear anodic finish.

c. Color and Pattern: Selected by Architect.

G. Factory Applied Wood Trim: Red oak not less than 1/2 inch (13 mm) thick; standard size and shape with transparent finish.

H. Vinyl Trim: Selected by Architect.

I. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board as indicated on approved Shop Drawings.

J. Combination Assemblies: Provide hidden spline between abutting sections of visual display panels.

K. Chalktray:
1. Continuous:
   a. Box Type: Extruded aluminum with slanted front, grooved tray, and cast aluminum end closures.
   b. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

L. Display Rail:
1. Extruded aluminum display rail with plastic impregnated cork insert, end stops, and continuous paper holder, designed to hold accessories:
   a. Size: 2 inches (50 mm) high by length indicated on Drawings.
   b. Map Hooks: Two map hooks for every 48 inches (1200 mm) of display rail or fraction thereof.
   c. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1200 mm) of display rail or fraction thereof.
   d. Flag Holder: One for each room.
   e. Tackboard Insert Color: Selected by Architect.
   f. Aluminum Color: Match finish of visual display assembly trim.

M. Paper Holder Display Rail: Extruded aluminum; designed to hold paper by clamping action.

N. Special Purpose Graphics: Fuse or paint semivisible writing guidelines, penmanship lines, music staff lines, grid, 1 inch (25 mm) square, rectangular graph coordinates, [polar graph coordinates] [horizontal lines, 2 inches (50 mm) o.c., graphic onto surface of porcelain enamel visual display unit. Exact location to be determined by District.

2.4 VISUAL DISPLAY ASSEMBLIES

A. Manufacturers:
1. Subject to compliance with requirements, provide products by one of the following:
   a. AJW Architectural Products.
   b. Claridge Products and Equipment, Inc.
   c. Egan Visual Inc.
   d. Platinum Visual Systems.

B. Markerboard Panel Assemblies:
1. Consisting of markerboard panels with high pressure laminate facing on core indicated, fabricated for floor-to-ceiling assemblies:
   a. Color: Selected by Architect.

C. Tackboard Panel Assemblies:

1. Consisting of tackboard panels with vinyl fabric or polyester fabric facing on core indicated, fabricated for floor to ceiling assemblies:
   a. Edge Treatments:
      1) Panel Joint Edges: Wrapped with fabric.
      2) Top of Wall Edges: Wrapped with fabric.
      3) Bottom of Wall Edges: Wrapped with fabric.
      4) Corners: Wrapped with fabric.
   b. Color: Selected by Architect.

D. Width: As indicated on Drawings.

E. Height: As indicated on Drawings.

F. Joint Accessories: Unless otherwise indicated concealed aluminum or steel spline at butt joints.

2.5 MODULAR SUPPORT SYSTEM FOR VISUAL DISPLAY BOARD ASSEMBLIES

A. Manufacturers:
   1. Subject to compliance with requirements, provide products by one of the following:
      a. AARCO Products, Inc.
      b. Architectural School Products Ltd.
      c. Claridge Products and Equipment, Inc.
      d. Platinum Visual Systems.

B. Standards:
   1. 72 inch (1829 mm) long extruded aluminum slotted standards designed for supporting visual display boards on panel clips. Space slots at not less than 4 inches (100 mm) o.c.:
      a. Finish and color: As selected by Architect.

C. Panel Clips: Extruded aluminum or steel with finish to match standards.

2.6 VISUAL DISPLAY CONFERENCE UNITS

A. Manufacturers:
   1. Subject to compliance with requirements, provide products by one of the following:
      a. A-1 Visual Systems.
      b. AARCO Products, Inc.
      c. Architectural School Products Ltd.
      d. Best-Rite; MooreCo, Inc.
      e. Claridge Products and Equipment, Inc.
      f. Egan Visual Inc.
      g. Ghent Manufacturing, Inc.
      h. Marsh Industries, Inc.
      i. Peter Pepper Products, Inc.
      j. Platinum Visual Systems.

B. Visual Display Conference Units:
   1. Factory fabricated units consisting of hinged door wood cabinet with perimeter face frame, sides, and back; not less than 3 inch (75 mm) interior depth and designed for surface wall mounting. Fabricate inside of cabinet and cabinet doors with fixed visual display units:
      a. Wood Cabinets - Fabricated from solid wood with integral, solid wood marker tray. Fabricate hinged door panels with solid wood frame and wood veneer exterior

surface:
1) Species and Finish: Red oak with natural lacquered finish.

b. Plastic Laminate Cabinets - Cabinet and hinged door panels fabricated from high pressure, plastic laminate finished wood panels; with integral marker tray:
1) Color: Selected by Architect.

c. Hardware - Full height continuous hinges, wire door pulls, and door bumpers.

d. Fixed Rear Panel - High pressure laminate markerboard panel:
1) Color: Selected by Architect.

e. Inside Surface of Doors - Same as fixed rear panel.

f. Inside Surface of Doors - Tackboard panel consisting of polyester fabric facing on core:
1) Color: Selected by Architect.

g. Projection Screen - Pull down, matte, white projection screen, not less than 8 inches (200 mm) smaller in each direction than overall cabinet size, and mounted above rear visual display panel.

h. Fluorescent Light - Minimum 24 inches (610 mm) long, and mounted above rear visual display panel.

i. Width - As indicated on Drawings.

j. Height - As indicated on Drawings.

k. Accessories - Cylinder lock and flip chart pad clamp.

2.7 FINISH REQUIREMENTS

A. Comply with NAAMM *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finishes:
1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
3. Baked Enamel or Powder Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements:
1. Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication:
a. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

3.2 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the work.

B. Examine roughing in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display units.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation. Clean substrates of substances, such as dirt, mold, and mildew, that impair the performance of and affect the smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces:
   1. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
   2. Prepare substrates indicated to receive glass writing surfaces required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color:
      a. Gypsum Board: Prime gypsum board with primer as recommended in writing by primer/sealer manufacturer and glass writing surface manufacturer.
      b. Painted Surfaces: Treat areas susceptible to pigment bleeding.

C. Prime wall surfaces indicated to receive visual display units, direct applied floor to ceiling visual display assemblies and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.4 INSTALLATION

A. Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field Assembled Visual Display Board Assemblies:
   1. Coordinate field assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit:
      a. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
      b. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support

accessories to suit conditions indicated.

c. Field Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at maximum 24 inches (610 mm) o.c.

C. Factory Fabricated Visual Display Board Assemblies:
1. Adhere to wall surfaces with egg size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically:
   a. Field Applied Aluminum Trim - Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at maximum 24 inches (610 mm) o.c.
   b. Mounting - Height Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated:
      1) Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalktray.
      2) Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalktray.
      3) Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalktray.

D. Factory Fabricated Visual Display Board Assemblies:
1. Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls:
   a. Field Applied Aluminum Trim - Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at maximum 24 inches (610 mm) o.c.
   b. Mounting Height - Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated:
      1) Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalktray.
      2) Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalktray.
      3) Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalktray.

E. Natural Slate Chalkboards:
1. Align and level joints between adjoining panels, and apply manufacturer's recommended joint filler compound. Hone and finish joints to continuous even plane:
   a. Field Applied Aluminum Trim - Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at maximum 24 inches (610 mm) o.c.
   b. Mounting Height - Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated:
      1) Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalktray.
      2) Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalktray.
      3) Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalktray.

F. Display Rails:
1. Install rails at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.:
   a. Mounting Height: 72 inches (1829 mm) above finished floor to top of rail.

G. Floor to Ceiling Markerboard Panels:
   1. Attach panels to wall surface with egg size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically:
      a. Join adjacent panels with concealed steel splines for smooth alignment.
      b. Join adjacent panels with exposed, H shaped aluminum trim painted to match wall panel.

H. Floor to Ceiling Tackboard Panels:
   1. Attach panels to wall surface with egg size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically:
      a. Install wrapped edge panels with butt joints between adjacent wall panels.
      b. Join adjacent panels with exposed, H shaped aluminum trim covered with same fabric as wall panels.

I. Rail Support System:
   1. Install horizontal support rail at mounting heights indicated on Drawings. Attach to wall with fasteners at 12 inches (300 mm) o.c.:
      a. Mounting Height: 72 inches (1829 mm) above finished floor to top of rail.
      b. Hang visual display units on rail support system.

J. Modular Support System:
   1. Install adjustable standards at mounting heights indicated on Drawings. Install standards at 48 inches (1200 mm) o.c., vertically aligned and plumb, and attached to wall with fasteners at 12 inches (300 mm) o.c.:
      a. Mounting Height: 12 inches (305 mm) above finished floor to bottom of standard.
      b. Install single slotted standard at each end of each run of standards and double slotted standards at intermediate locations.
      c. Provide locking screw at top corner of visual display board at each standard.
      d. Hang visual display units on modular support system.

K. Sliding Visual Display Units:
   1. Install units at mounting heights indicated. Attach to wall framing with fasteners at not more than 16 inches (400 mm) o.c.:
      a. Adjust panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

L. Visual Display Conference Units:
   1. Install units at mounting heights indicated on Drawings. Attach to wall surface with concealed brackets screwed to wall:
      a. Mounting Height: 72 inches (1829 mm) above finished floor to top of cabinet.

3.5 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 21 13 TOILET COMPARTMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Toilet partitions.
   2. Urinal screens.
   3. Entrance screens.
   4. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 06 10 00: Rough Carpentry.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings - Submit plans, elevations, sections, details, and attachments to other work:
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.
   3. Show locations of centerlines of toilet fixtures.
   4. Show ceiling grid and overhead support or bracing locations.

C. Samples: Submit for each type of unit with samples of hardware and accessories involving material and color selection.

D. Maintenance Data: Submit data to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

A. Accessible Toilet Compartments:
   1. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
   2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with CBC Section and Figure 11B-604.8.1.4. It shall be a minimum of 9 inches high above the finish floor, and a minimum of 6 inches deep beyond the compartment side face of the partition, exclusive of partition support members. It shall be a minimum of 12 inches high above the finish floor for children’s use. Partition components at toe clearances shall be smoother without shop edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66 inches wide.
   3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets total six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per CBC Section 11B-213.3.1 and shall comply with CBC Section 11B-604.8.2.

4. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Section 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches minimum. See CBC Figure 11B-604.8.2.
5. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
6. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area. See CBC Section 11B-604.8.2.2.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements - Comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
      b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
         1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
   2. Surface Burning Characteristics - Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency:
      a. Flame Spread Index: 25 or less.
      b. Smoke Developed Index: 450 or less.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide products by one of the following:
   1. Solid Plastic (HDPE):
      a. Scranton Products; Capitol Partitions, Comtec Industries. Basis of Design.
      b. Accurate Partitions Corp.; ASI Group.
      c. Ampco Products, LLC.
      d. General Partitions Mfg. Corp.
      e. Global Partitions; ASI Group.
      f. Metpar Corp./Sanymetal

B. Aluminum Castings: ASTM B26/B26M.

C. Aluminum Extrusions: ASTM B221.

D. Stainless Steel Sheet: ASTM A666, Type 304, stretcher leveled standard of flatness.

E. Stainless Steel Castings: ASTM A743/A743M.

2.2 PARTITION COMPONENTS

A. Solid Plastic Partitions:
   1. Style:
      a. Toilet Partition: Floor anchored and overhead braced.
      b. Entrance Screen Style: Floor supported and overhead braced.
      c. Urinal Screen Style: Floor anchored and overhead braced.

B. Door, Panel, Screen, and Pilaster Construction - Solid, high density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no sightline system**,** and with homogenous color and pattern throughout thickness of material:
   1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
   2. Heat Sink Strip: Continuous, stainless steel strip fastened to exposed bottom edges of solid plastic components to hinder malicious combustion.
   3. Color and Pattern: Selected by Architect.
   4. Pilaster Shoes and Sleeves (Caps) - Stainless steel:
      a. Pilaster shall be attached to the floor by means of an 11 gauge stainless steel footer, with provisions for leveling, attached to two (2) 3/8 inch diameter stainless steel studs set into expansion shields. The floor connections are to be covered by a four (4) inch high stainless steel shoe, #4 finish.
      b. Option Panels: 1/2 inch thick solid phenolic core with high pressure color surface on faces. Edges shall be burnished and slightly rounded.

C. Urinal Screen Post: Post design of stainless steel matching the thickness and construction of pilasters or 1-3/4 inch (44 mm) square, aluminum tube with satin finish; with shoe and sleeve (cap) matching that on the pilaster.

D. Brackets (Fittings):
   1. Stirrup Type: Ear or U-brackets, stainless steel.
   2. Full Height (Continuous) Type: Stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories - Heavy duty operating hardware and accessories:
   1. Hinges: Minimum 0.062 inch (1.59 mm) thick, full door length, stainless steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through bolts.
   2. Latch and Keeper: Heavy duty surface mounted cast stainless steel latch unit designed to resist damage due to slamming, with combination rubber faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
   3. Coat Hook: Heavy duty combination cast stainless steel hook and rubber tipped bumper, sized to prevent in swinging door from hitting compartment mounted accessories. Mount with through bolts.
   4. Door Bumper: Heavy duty rubber tipped cast stainless steel bumper at out swinging doors and entrance screen doors. Mount with through bolts.
   5. Door Pull: Heavy duty cast stainless steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.

B. Overhead Bracing: Continuous, extruded aluminum head rail with antigrip profile and in standard finish.

C. Anchorages and Fasteners: Exposed fasteners of stainless steel, finished to match the being secured, with theft resistant type heads. Provide sex type bolts for through bolt applications. For concealed anchors, use stainless steel, hot dip galvanized steel, or rust resistant, protective coated steel compatible with related materials.

2.4 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through partition toilet accessories where required for attachment of toilet accessories.

B. Overhead Braced Units: Provide corrosion resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor Anchored Units: Provide corrosion resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Urinal Screen Posts: Provide corrosion resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

E. Door Size and Swings: Unless otherwise indicated, provide 24 inch (610 mm) wide, in swinging doors for standard toilet compartments and 36 inch (914 mm) wide, out swinging doors with a minimum 32 inch (813 mm) wide, clear opening for compartments designated as accessible.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

3.2 EXAMINATION

A. Examine areas and conditions for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the work. Confirm location and adequacy of blocking and supports required for installation. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

A. Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices:
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch (13 mm).
      b. Panels and Walls: 1 inch (25 mm).
   2. Stirrup Brackets - Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel:
      a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.
   3. Full Height (Continuous) Brackets - Secure panels to walls and to pilasters with full height brackets:
      a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.

B. Overhead Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position. Attach wall brackets into solid backing/blocking and/or wall studs. No drywall anchors allowed.

C. Floor Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact. Attach wall brackets into solid backing/blocking and/or wall studs. No drywall anchors allowed.

3.4 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out swinging doors to return doors to fully closed position.

3.5 MAINTENANCE MATERIAL

A. Furnish extra materials that match products installed and packaged with protective covering for storage and identified with labels describing contents and source:
   1. Door Hinges: One hinge(s) with associated fasteners.
   2. Latch and Keeper: One latch and keeper(s) with associated fasteners.
   3. Door Bumper: One bumper(s) with associated fasteners.
   4. Door Pull: One door pull(s) with associated fasteners.
   5. Fasteners: Ten fasteners of each size and type.

END OF SECTION 10 21 13

SECTION 10 28 13 TOILET ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Public use washroom accessories.
   2. Public use shower room accessories.
   3. Private use bathroom accessories.
   4. Healthcare accessories.
   5. Warm air dryers.
   6. Childcare accessories.
   7. Underlavatory guards.
   8. Custodial accessories.
   9. Accessories necessary for a complete installation.

1.3 PERFORMANCE REQUIREMENTS

A. Sanitary Facility Elements:
   1. Elements of sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.
   2. Grab bars in toilet facilities and bathing facilities shall comply with CBC Section 11B-609.
   3. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
      a. 1 ½ inches between the grab bar and the wall.
      b. 1 ½ inches minimum between the grab bar and projecting objects below and at the ends.
      c. 12 inches minimum between the grab bar and projecting objects above.
   4. Grab Bars to meet DSA IR 16-12 – Grab Bar Design and Connections: 2022 CBC.
      a. Grab Bars shall be designed to resist a single concentrated load of 250 lbs. applied in any direction at any point o the grab bar such as to produce the maximum load effect.

1.4 SUBMITTALS

A. Product Data:
   1. Technical Data including construction details, material descriptions, dimensions of individual components and profiles, and finishes:
      a. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
      b. Include electrical characteristics.

B. Samples:
   1. Full size, for each exposed product and for each finish specified:
      a. Approved full size Samples will be returned and may be used in the Work.

C. Product Schedule: Show types, quantities, sizes, and installation locations by room of each accessory required. Identify locations using room designations indicated.

D. Maintenance Data: Submit for inclusion in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Accessibility Requirements:
   1. Comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design
      b. 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
         1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Source Limitations: Obtain products from single source from single manufacturer.

1.6 WARRANTY

A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period:
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Toilet accessories schedule is based on Bobrick Washroom Equipment. Subject to compliance with requirements, provide products by one of the following:
      a. Bobrick Washroom Equipment, Inc. Basis of Design.
      b. AJW Architectural Products.
      c. American Specialties, Inc.
      d. Bradley Corporation.
      e. Brey-Krause Manufacturing Co.
      f. GAMCO Specialty Accessories; a division of Bobrick.
      g. Tubular Specialties Manufacturing, Inc.

B. Stainless Steel: ASTM A666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

C. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

D. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

E. Galvanized Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot dip zinc coating.

F. Galvanized Steel Mounting Devices: ASTM A153/A153M, hot dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear glass mirrors, nominal 6.0 mm thick.

I. Electric Dryer:
   1. Product - Model RA5-974 by World Dryer:
      a. Material: Cover made of 1/4” thick cast iron with porcelain enamel finish.
      b. Motor shall be universal type, 1/10 HP at 7500 RPM. Dryers shall deliver 200 cubic feet per minute of air volume (7300 LFM).
      c. Timer shall be electromechanical cam-style with 25 AMP rated switch to operate dryer for 30 second period on push button units.
      d. Infrared sensor detects hands, initiates and terminates drying on automatic units.
      e. Recessed units are made with cast iron covers and use a 16-gauge steel wall mounting box.
      f. Hand dryers shall be listed under reexamination service of Underwriters Laboratories, Inc.

2.2 COMPONENTS

A. Underlavatory Guard:
   1. Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with piping and/or burns from piping; allow service access without removing coverings:
      a. Product: Truebro LavShield Protective Lavatory Enclosure.
      b. Material and Finish: Antimicrobial, molded plastic, white.
      c. Provide at all lavatories.

2.3 FABRICATION

A. Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

3.2 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level,

plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F446.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items. Remove temporary labels and protective coatings. Clean and polish exposed surfaces according to manufacturer's written recommendations.

PART 4 SCHEDULE

4.1 ACCESSORY SCHEDULE

A. TA-1 - Soap Dispensers:
1. Mounting: Surface.
2. Model No.: B-2111 (vertical)
3. Model No.: B-2112 (horizontal).
4. Locations: Refer to drawings.

B. TA-1(a) – Multiple Soap Dispensers:
1. Multi-Feed Soap Dispensing System: B-820 Automatic, with 820-248 Automatic Foam Dispenser or 820-258 Automatic Liquid Dispenser.

C. TA-2 - Mirrors:
1. Mounting: Surface.
2. Model No.: B-290.
3. Size: 24 inches by 36 inches (600 mm by 900 mm), unless shown otherwise.
4. Locations: Refer to drawings.

D. TA-3 - Toilet Paper Dispensers (At Typical Non-accessible Toilet Stalls):
1. Mounting: Surface.
2. Model No.: B-2888. (At Typical Non-accessible Toilet Stalls),
   B-35883 (At Accessible Stalls)
3. Locations: Non-accessible water closets and toilet stalls.

E. TA-4 - Paper Towel Dispensers:
1. Mounting: Surface (Less than 4” projection)
2. Model No.: B-262.
3. Locations: Refer to drawings.

F. TA-5 - Grab Bars: Typical Accessible Toilet Stalls:
1. Size/Finish: 42” x 1-1/2 inch diameter satin stainless steel
2. Clearance: 1-1/2 inch between rail and wall.
3. Model No.: B-6806.
4. Mounting: Attach with concealed mounting kit. Mount parallel to floor.
5. Location: Accessible water closets and toilet stalls.

G. TA-6 - Sanitary Napkin Dispensers:
1. Mounting: Recessed.
2. Model No.: B-2706.
3. Operation: Single coin / Double coin - (25/50 cents).
4. Capacity: 20 Napkins/ 30 Tampons.
5. Locations: Women’s toilet room.

H. TA-7 - Sanitary Napkin Disposal:
   1. Mounting: Surface.
   2. Model No.: B-270.
   3. Capacity: 1.0 gal.
   4. Locations: Women's toilet stalls.

I. TA-8 - Mop and Broom Holder:
   1. Mounting: Surface.
   2. Model No.: B-239 x 34.
   3. Capacity: Four hooks, three mop holders.
   4. Locations: Mop sink at each custodial rooms.

J. TA-9 - Toilet Paper Dispensers – Single-recessed
   1. Mounting: Single-recessed (Less than 4" projection).
   2. Model No.: B-667.
   3. Location: Accessible water closets and toilet stalls.

K. TA-10(a) - Folding Benches: Adult Height:
   1. Mounting: Surface, reversible.
   2. Models: B-5181.
   3. Locations: Accessible shower stalls.

L. TA-11 - Clothes Hook:
   1. Mounting: Surface.
   2. Model No.: B-6717.
   3. Locations: All shower locations.
   4. Toilet and Shower Partitions: If toilet and shower partitions are utilized, hooks are to be provided by the partition manufacturer(s) as part of their hardware package.

M. TA-12 - Shower Curtains, Rods and Hooks:
   1. Rods: B-047 (36 inches or as indicated).
   2. Curtains: B-6047 to 72" (42 inches x 72 inches or as required).
   3. Hooks: B-204-1.
   4. Mounting/Locations: Accessible shower stalls.

N. TA-13- Electric Hand Dryers:
   1. Mounting: Semirecessed, maximum 3-9/16 inch recess.
   2. Model No.: B-750, white.
   3. Voltage: 120 volt, single phase.
   4. Location: Refer to drawings.

O. TA-14 - Paper Towel Dispenser/Trash Receptacle Combination:
   1. Mounting: Surface.
   2. Model No.: B-3949.
   3. Locations: Refer to drawings.

P. TA-15 - Grab Bars: (At Typical Semi-ambulatory Toilet Stalls):
   1. Size/Finish: 42" x 1-1/2 inch diameter satin stainless steel
   2. Clearance: 1-1/2 inch between rail and wall.
   3. Model No.: B-6806-42.
   4. Mounting: Attach with concealed mounting kit. Mount parallel to floor.
   5. Location: Semi-ambulatory toilet stalls.

Q. TA-16 - Diaper Changing Stations:
   1. Type: Horizontal station to accommodate infants and toddlers.

2. Construction and Features:
   a. FDA approved injection molded polypropylene with steel on steel hinge system. Fabricate to withstand static loads over 400 pounds.
   b. Child protection straps with snap lock fasteners.
   c. Built in diaper bag hooks.
   d. Built in sanitary liner dispensers; 3 ply, biodegradable.
   e. Premium gas spring mechanism.
   f. Molded usage and safety instructions in six languages and Braille.
   g. ADA compatible.
   h. Antifungal to comply with ASTM standards.
3. Color: Selected by Architect from the full list of standard colors.
4. Dimensions: 35 inches long by 22 inches high by 4 inches deep (875 mm by 550 mm by 100 mm).
5. Approved Product/Manufacturer: Koala Bear Kare Baby Changing Stations, Model KB 200, manufactured by Koala Bear Kare.

R. TA-17 - Trash Receptacle:
1. Mounting: Recessed
2. Model No.: B3644.
3. Locations: Refer to drawings.

S. TA-18 - Toilet Paper Dispensers:
1. Mounting: Semi-recessed (Less than 4” projection).
2. Model No.: B-3888.
3. Location: Accessible water closets and toilet stalls.

T. TA-19 - Seat Cover Dispenser:
1. Mounting: Surface.
2. Model No.: B-221
3. Location: All water closets and toilet stalls.

U. TA-20 - Sanitary Napkin Disposal:
1. Mounting: Semi-recessed.
2. Model No.: B-353.
3. Locations: Women’s accessible toilet stalls.

END OF SECTION 10 28 13

SECTION 10 44 00 FIRE EXTINGUISHER AND CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
1. Fire Extinguisher Cabinets.
2. Fire Extinguishers

B. Related Sections:
1. Section 06 10 00: Rough Carpentry.

1.3 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and technical data to indicate specification compliance.
2. Manufacturer’s installation instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Specifications are based on the products of named manufacturers. Other listed manufacturers who produce products equivalent to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years’ experience manufacturing equivalent to those specified and comply with Division 01 requirements regarding substitutions to be considered:
1. Larsen's Manufacturing Co.
2. The Williams Bros. Corporation of America.
3. J. L. Industries, Inc.
4. Potter-Roemer.

2.2 MATERIALS

A. Fire Extinguishers and Cabinets must comply with CBC Sections 11B-307, 11B-308, 11B-309, and 11B-403.

B. Fire Extinguisher Cabinets (FEC):
1. Size: 24 inches x 9-1/2 inches x 6 inches inside tub dimension.
2. Type: Semi-recessed with 2-1/2 inch return trim rolled edge; ADA compliant.
3. Tub Construction: 22 gauge min. steel with standard baked acrylic enamel interior finish.
4. Door and Frame: 18 gauge min. 304 stainless steel door and frame with vertical decal lettering "FIRE EXTINGUISHER" in red color, unless directed otherwise by Architect.
5. Glazing: clear acrylic “Duo” vertical glazing panel
6. Hardware: Continuous concealed piano hinge constructed of material which matches door and trim material. Satin finish pull handle with cam cylinder lock with safety pull designed to release upon firm pull on handle (Larsen’s “Larsen-Loc”™, J.L. Industries

"Saf-T-Lok"™; or equivalent).
7. Bracket: Hook type; Larsen's #1007, or equal.
8. Finish of Exterior: #4 Stainless steel.
9. Fire rating: as occurs, provide fire rated cabinet, for one or two hour rated conditions as indicated or required by specific location. Cabinet shall be tested and approved by Warnock Hersey to ASTM E814, and shall bear the Warnock Hersey label.

C. Fire Extinguishers (F.E):
1. Models/Types:
   a. Multipurpose dry chemical with 10 lbs. capacity: C rating conforming to MP10 Series. UL Rating: 4A:80B:C.
   b. Wet-Chemical Type, WC Series, (FE-K): UL-rated 2-A: K, 2.5-gal. (9.5-L) nominal capacity, with potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage.
2. Mounting: Provide eye brackets for direct wall mounting to hook and for mounting in Fire Extinguisher cabinets. Refer to drawings for location and quantity.
3. Provide initial inspection tag for each extinguisher.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fire extinguishers and cabinets in openings in accordance with manufacturer's printed instructions.

B. Install fire extinguishers and cabinets where indicated on the drawings, or if not indicated, in locations required by governing code and as directed by Owner.

END OF SECTION 10 44 00

SECTION 22 00 00 - GENERAL PLUMBING PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 22.

1.2 CODES AND REGULATIONS

A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:

1. California Code of Regulations – CCR:
   a. Title 8, Industrial Relations.
   b. Title 24, Building Standards.
2. California Building Code – CBC.
3. California Mechanical Code – CMC.
4. California Plumbing Code – CPC.
5. California Fire Code – CFC.
6. California Green Building Code.
7. American Gas Association – AGA.
8. American National Standards Institute – ANSI.
9. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
10. American Society of Mechanical Engineers – ASME.
11. American Society for Testing and Materials – ASTM.
12. American Water Works Association – AWWA.
13. Cast Iron Soil Pipe Institute – CISPI.
14. California Electrical Code – CEC.
15. National Electrical Manufacturers Association – NEMA.
16. National Fire Protection Association – NFPA.
17. National Sanitation Foundation – NSF.
18. Plumbing and Drainage Institute – PDI.
19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
20. Underwriters' Laboratory – UL.
21. Occupational Safety and Health Act - OSHA.
22. California Assembly Bill 1953 (AB1953).
23. ASCE 7-16, Chapter 13.

1.3 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK

A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, fixtures, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
   1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
   2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
   3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.

C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations

and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.

D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. WH-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Water Heaters, Pumps, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)**

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.

C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, sewer, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative,

the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 PROTECTIVE COATING FOR UNDERGROUND PIPING

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.2 CONCRETE ANCHORS

A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.3 SEISMIC RESTRAINTS

A. All plumbing systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Seismic Restraint Systems Guidelines” OPM-0052-13 by Eaton/ Tolco.

2.4 SYSTEM IDENTIFICATION

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. WH-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.

2.5 EQUIPMENT SUPPORT FRAMES

A. Unless specifically noted otherwise, it shall be the responsibility of Plumbing Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.

B. Plumbing Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.

C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

D. **IAQ Management plan will be in effect for Cal Green requirements. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.3 EXCAVATION AND BACKFILL

A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.

B. Backfill:
   1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
   2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
   3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.

C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

A. Piping and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 22 00 00

SECTION 22 00 01 - PLUMBING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing Section 22 00 00, General Plumbing Provisions shall form a part of this specification.

1.2 SCOPE

A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating plumbing system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
   1. Sanitary sewer system.
   2. Domestic water system.
   3. Plumbing fixtures.
   4. Plumbing equipment.

Work Specified Elsewhere:

   5. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the Electrical Division, unless otherwise noted.
   6. Access doors.
   7. Concrete and reinforcing steel.
   8. 23 00 01, Heating, Ventilating and Air Conditioning.

1.3 CODES AND STANDARDS

A. All pipe, pipe or plumbing fittings or fixture, solder, or flux shall be lead free that provides water for human consumption per California Assembly Bill 1953 (AB1953).

B. See Section 22 00 00 for additional requirements.

1.4 SUBMITTALS

A. Provide product data for all materials per Division 01.

PART 2 MATERIALS

2.1 PIPING MATERIALS

A. Sanitary Sewer:
   1. Soil, Waste and Vent Piping:
      a. Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings. Plain end with neoprene gasket and stainless steel retaining sleeve, CISPI 301, ASTM A888 hubless cast-iron, or hub end with rubber gasket, ASTM A74, ASTM C564. Size 2” and smaller above grade may be standard weight galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12. All cast iron pipe and couplings shall be American made and tested, no imported pipe or coupling is acceptable. Use heavy-duty (4-Band)

couplings for all soil and waste piping. Use standard (2-Band) couplings for all vent piping. Tyler Pipe, AB & I Foundry or Charlotte Pipe. Couplings shall be Tyler, Anaco or Husky.

b. Outside Building:
   1) For domestic waste only: Polyvinyl chloride gravity sewer pipe with bell and rubber Z-gasket, ASTM D3034, SDR 35. Carlon, J.M.
   2) PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
   3) Where cover is less than 15", pipe shall be cast iron, same as for inside of building.

2. Cleanouts: Floor cleanouts: Smith 4020 with nickel bronze top in finished areas; Smith 4220 in utility areas. Wall cleanouts: Smith 4530 with stainless steel cover and screw. Comparable models of Josam, Wade, Zurn or equal.
3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic area; G5 in roadways.

B. Water :

C. Cold Water Piping:
   a. Inside Building: Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. Vacuum pipe shall have long sweeping elbow fittings. 95/5 tin-silver soldered joints. Brazesafe, Silcan or equal brazing material.
   b. Outside Building Below Grade: Same as Inside Building with protective coating on ferrous pipe or Schedule 40 PVC pipe thru 2", Class 315 2" thru 4".

D. Valves and Specialties:
   1. Valves:
      a. General: Manufacturer's model numbers are listed to complete description. Milwaukee, Kitz, Apollo, Nibco, Stockham or equal. All valves shall be full size of upstream piping. **Ball valves shall be substituted for gate valves 2" and smaller. Butterfly valves shall be substituted for gate valves 2-1/2" and larger. C_V factors for ball valves shall not be less than equal size gate valves.**
      b. Gate Valve: 2" and smaller: All bronze, rising stem, union bonnet, wedge disk, 200 psi WOG. Milwaukee No. 1152. The material of the valve stem shall be limited to a maximum of six (6) percent zinc content. 2-1/2" and larger: Iron body, bronze mounted. Non-rising stem. Wedge disk. 200 psi WOG. Flanged or AWWA hub as applicable. Open/ closed indicator. Milwaukee No. F2882. Underground valves shall have square operating nut.
      c. Check Valve: 2" and smaller: All bronze swing check, regrinding. 200 psi WOG. Milwaukee No. 509, 1509 or equal. 2-1/2" and larger: Non-slam type, 125 psi iron body wafer type with renewable seats and stainless steel spring. Milwaukee 1400 series or equal.
      d. Plug Valve: Eccentric bronze plug. Nickel chromium alloy iron body. Bronze bushings. Buna-N O-rings. UL approved for gas distribution. 175 psi WOG. DeZurick Series 400 or equal.
      e. Ball Valves: Two or three piece construction, forged bronze body, chrome plated brass ball, threaded ends, teflon seats, PTFE or reinforced teflon stem seals, lever handle. Underground valves shall have "T" handle. Provide one operating "T" extension handle for all underground valves. Milwaukee BA100/150, BA300/350, Nibco or equal.
      f. Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic areas: G5 in roadways.
      g. Butterfly Valve: Iron Body, Aluminum bronze disk (connection to shaft shall not be by pins, screws, or bolts). Ductile body PPS coated with EPPM coated ductile

disc. O-ring seals. Resilient removable seat. 416 stainless steel two piece shaft. 6” and smaller valves shall have multi-position lever handle. Underground valves shall have square operating nut. Provide one operating “T” handle for underground valves. Provide 2” extension neck at insulated pipes. Milwaukee “C” series, Kitz or equal.

E. Miscellaneous Piping Items:
   1. Pipe Support:
      a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum load per manufacturer's recommendation. Felt lined, B-Line B3690F, Unistrut or equal.
      b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut or equal.
   2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.
   3. Flashing: Vent flashing and flashing for piping through roof shall be prefabricated 24 gauge galvanized steel roof jacks with 8" square flange around pipe sealed with weatherproofing mastic.

2.2 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Pipe Insulation: Elastomeric type, ASTM C534, with a thermal conductivity of 0.27 at 75°F when measured in accordance with ASTM C177 or ASTM C518.
   1. Wall thickness: 3/4 in.
   2. Adhesive: Conform to Manufacturer's recommendations.

C. Pre-molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all-service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-sq. ft-degrees F, at a mean temperature of 50 degrees F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes less than 2", 1-1/2" thickness for pipe sizes 2" and larger. CSG Insulation Corp., Manville, Owens-Corning or equal.

D. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr sq. ft-degrees F, at a mean temperature of 50 degrees F. 1-1/2" thickness. Manville, Owens-Corning or equal.

E. PVC Jacket (for exposed pipes and fittings): Pre-molded polyvinyl chloride (PVC) jackets. Size to match application. Provide PVC vapor barrier, pressure-sealing tape by same manufacturer. Zeston or equal.

2.3 FIXTURES

A. General: This Division shall rough-in for and install all plumbing fixtures shown on drawings. All trim not concealed shall be brass with polished chromium plate finish unless otherwise noted. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.

B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures. Manufacturer's model numbers are listed to complete description. Water consumption

quantities listed on schedule are maximum. Equivalent models of American Standard, Crane, Haws, Kohler, Eljer, Zurn or equal. For drainage fixtures, equivalent models of Josam, Smith, Wade, Zurn or equal.

C. Stops and P-traps: All fixtures shall be provided with stops and p-traps as applicable.
   1. Stops: All hot and cold water supplies shall be 1/2" angle stops with IPS inlets and compression outlets, stuffing box, screwdriver lock shield, and 1/2" flexible brass tubing riser. Speedway. Wall mounted trim shall have concealed loose key wall stop. Chicago 1771 or equal.
   2. P-traps: Brass, ground joint. 17 gage. American Standard, California Tubuler or equal.
      a. Trap primers shall be provided with ball valve and cylinder key-lock access panel for all floor drains and floor sinks. PPP, Inc. or equal.

2.4 EQUIPMENT

A. General Requirements:
   1. General: These equipment specifications are to supplement the drawings. Refer to schedules on drawings for the specific equipment to be provided. Capacities shall be in accordance with the schedules shown on the drawings. Capacities are to be considered minimum.
   2. Dimensions: Equipment must conform to space requirements and limitations as indicated on the drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions.
   3. Ratings: Electrical equipment shall be in accordance with NEMA Standards and UL listed where applicable standards have been established.
   4. Basis of Design: Manufacturers and model numbers listed in schedules as the basis of design are intended to represent the standard of quality and the features desired.
   5. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
   6. Electrical:
      b. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls not included in equipment package. Manual and magnetic starters shall have ambient compensating running over-current protection in all ungrounded conductors. Magnetic starters shall be manual reset. Controllers and other devices shall be in NEMA 3 or 12 enclosures as applicable.
      c. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
      d. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip-proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction. Design shall limit starting inrush current and running current to values shown on drawings.
      e. Starters: Motor starters shall be provided for all equipment except where starter is in a motor control center as designated on the electrical drawings.
      f. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt transformer if separate source is not indicated on plans. 240 volt

control is acceptable if confined within control panel.

g. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Owner's Representative. No structural member shall be cut, notched, bored, or otherwise altered unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. All exposed piping to be primed and painted, see painting section.
2. Joints:
   a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
   b. Welded or Brazed: Filler rod shall be of the same suitable alloy as pipe. Welding or brazing shall be performed in accordance with requirements of recognized published standards of practice and by licensed or otherwise certified contractors. Welder or Brazer shall be a person who specialized in welding or brazing of pipes and holds a recognized certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
   c. Other: Joints other than threaded or welded shall be installed in accordance with manufacturer's recommendations.
   d. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
   e. Electrical Equipment: Joints shall be avoided, where possible, over electrical equipment.
   f. Copper pipe 1-1/2" or less may be soldered. Above 1-1/2" and all below grade shall be brazed.
3. Fittings:
   a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
   b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
   c. Unions: A union shall be installed on the leaving side of each valve, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
   d. Valves: All valves shall be full line size. At equipment connections, valves shall be full size of upstream piping.
4. Pipe Support:
   a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for

additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. All pressure piping, drainage piping above grade and metallic piping of dissimilar metal from hangers shall have isolating shield, or felted hangers.

1) Screwed Pipe:

Pipe Size Between Supports*	Max. Spacing
(in)	(ft)
½	6
¾	8
1	8
1-1/4 & larger	10

* Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves, or other fittings.

2) Copper Tubing: Copper tubing shall be supported at approximately six (6) foot intervals for piping one and one-half (1-1/2) inches and smaller in diameter and ten (10) foot intervals for piping two (2) inches and larger in diameter.

3) Gravity Drainpipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.

b. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for approval.

5. Excavation and Backfill: Minimum cover on all piping shall be as follows unless otherwise noted:
   a. Up to 2-1/2" pipe - 24" cover.
   b. 3" and larger pipe - 30".
6. Miscellaneous:
   a. Escutcheons: Provide chromium plated escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
   b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" clearance between sleeve and pipe or pipe insulation.
   c. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.
   d. Shock Absorbers: Install per manufacturers recommendations.

B. Water Piping: Connections to branches shall be made from the top side of the main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Provide ball valve shutoff for each building and at each connection to equipment and trap primers. Shock absorbers shall be installed in a vertical position at end of branch runs as specified in this section whether specifically shown or not on drawings. Connections to equipment shall be made with flexible connectors. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs.

3.2 PIPING INSULATION INSTALLATION

A. Domestic Tempered Water Supply:
   1. General: All domestic tempered water supply piping, except for exposed connections to fixtures, shall be insulated. Do not insulate unions or valves less than 2", unless exposed to weather.
   2. Install elastomeric pipe insulation by slipping over end of pipe. Where not feasible, slit insulation longitudinally, snap over piping and seal with adhesive. Insulate fittings with larger diameter sleeves or insulation, lapping pipe insulation a minimum of 2 in.
   3. Butt sections of insulation tightly together and seal with adhesive to provide a continuous vapor and thermal barrier.

4. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied sealing tape.
5. Fittings and Valves:
   a. Wrap fitting with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Seal all joints with factory supplied pressure sealing vapor barrier tape with 2" (min.) overlap on both sides of joint. Insulate valves to stem.
   b. For miscellaneous fittings for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the contractor may cover the fiberglass blanket with stretchable glass fabric and at least two coats of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

B. ADA Compliant Fixtures:
1. At sinks/ lavatories which are to be ADA Compliant, the p-trap and angle stop assemblies shall be insulated with Trap Wrap Protective Kit 500R by Brocar, Truebro Handi Lav-Guard #102W or #105W or equal. Abrasion resistant exterior cover shall be smooth and have 1/8" wall minimum over cushioned foam insert. Fasteners shall remain substantially out of sight.

3.3 FIXTURE INSTALLATION

A. Fixture Height: Shall be standard height except those specified as ADA Compliant. Such fixtures shall be mounted in accordance with CBC, Section 11B, Division 6 and drawing details.

B. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. “Sanitary SCS1700” silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

3.4 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment.

B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.5 TESTS AND ADJUSTMENTS

A. General: Unless otherwise directed, tests shall be witnessed by the Owner’s Representative. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test, and repair his work, and that of other contractors, to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections. However, all connections between sections previously tested and new section shall be included in the new test. New sections shall be isolated from existing sections for testing purposes. There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.

B. Gravity System:

1. Sanitary Sewer: All ends of the new sections of sewer system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
2. Condensate Piping: Maintain 15 psig water pressure for a duration of 4 hours.

C. Pressure Systems:
1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
2. Domestic Tempered & Cold Piping: Maintain 60 psig water pressure for a minimum duration of 2 hours.

D. Accessible Lavatories:
1. Faucet controls and operating mechanisms shall be installed and tested to comply per CBC Section 11B-606.4.

3.6 DISINFECTION

A. Disinfect all domestic hot and cold water piping systems in accordance with California Plumbing Code Sections 609.9.1 through 609.9.4. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following:
1. The pipe system shall be flushed with clean, potable water until potable water appears at the points of outlet.
2. The system or parts thereof shall be filled with a water-chlorine solution containing not less than 50 parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water-chlorine solution containing not less than 200 parts per million of chlorine and allowed to stand for 3 hours.
3. Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.
4. The procedure shall be repeated where it is shown by bacteriological examination made by an approved agency that contamination persists in the system.

B. Disinfection process shall be performed by certified testing agency or in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected by certified testing agency or by health department for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Owner’s Representative.

END OF SECTION 22 00 01

SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.2 CODES AND REGULATIONS

A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
   1. California Code of Regulations – CCR:
      a. Title 8, Industrial Relations.
      b. Title 24, Building Standards.
   2. California Building Code – CBC.
   3. California Mechanical Code – CMC.
   4. California Plumbing Code – CPC.
   5. California Fire Code – CFC.
   6. California Green Building Code.
   7. Air Diffusion Council – ADC.
   8. American Gas Association – AGA.
   9. Air Moving and Conditioning Association – AMCA.
   10. American National Standards Institute – ANSI.
   11. Air Conditioning and Refrigeration Institute – ARI.
   12. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
   13. American Society of Mechanical Engineers – ASME.
   14. American Society for Testing and Materials – ASTM.
   15. American Water Works Association – AWWA.
   16. California Electrical Code – CEC.
   17. National Electrical Manufacturers Association – NEMA.
   18. National Fire Protection Association – NFPA.
   19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
   20. Underwriters' Laboratory – UL.
   21. Occupational Safety and Health Act - OSHA.
   22. ASCE 7-16, Chapter 13.

1.3 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK

A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical, or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
   1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
   2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
   3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.

C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the

specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.

D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)**

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.

C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.

D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of

reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 PROTECTIVE COATING FOR UNDERGROUND PIPING

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.2 CONCRETE ANCHORS

A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.3 SEISMIC RESTRAINTS

A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with details on the drawings.

2.4 SYSTEM IDENTIFICATION

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, shut-off valves at equipment and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.

D. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.5 EQUIPMENT SUPPORT FRAMES

A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.

B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.

C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

D. **IAQ Management plan will be in effect for Cal Green Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.3 EXCAVATION AND BACKFILL

A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.

B. Backfill:
   1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
   2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the

Engineer.

3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.

C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

A. Piping, ductwork, and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 23 00 00

SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing Section 23 00 00, General Mechanical Provisions shall form a part of this specification.

1.2 SCOPE

A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
1. Heating, ventilating and air conditioning equipment.
2. Air distribution system (Ductwork, Air Terminals, etc.).
3. System insulation.
4. Controls and control wiring and conduit for control wiring.

B. Work Specified Elsewhere:
1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the electrical section.
2. Connection of gas and condensate drains to equipment.
3. Access doors.

PART 2 MATERIALS

2.1 DUCTWORK MATERIALS

A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.

B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A653.

C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu/hr. sq. ft.- degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./ min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.

D. Spiral Duct: Ductwork shall be galvanized steel with uni-seal spiral seamlock and uni-seal fittings, ASTM A653. United McGill Corp or equal. All exposed spiral duct shall be painted, color selected by Owner.

E. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.

F. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex or equal.

G. Duct Joints:
1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
   a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
   b. Ducts 48 inches and larger, Ductmate Regular, Nexus (SMACNA "J" Type connection) or equal.

H. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast, Inc., United McGill Uni-Cast or equal.

2.2 AIR TERMINALS AND DUCT FITTINGS

A. Grilles: (Grilles, Registers and Diffusers)
1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of J & J, Krueger, Barber-Colman, Anemostat, Price, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be re-selected by the Contractor for the proper diffusion, spread, drop, and throw.
3. Frame and Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
5. Gyms: Provide 12 Ga. wire safety cables for all overhead grilles in Gym.

B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP or equal.

C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.

D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6” maximum blade width, 16-gage blade, 48” maximum length, nylon or oil impregnated bronze bearings, ½” diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1” less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body, and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12” length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

E. Fire/ Smoke Damper: Multi-blade construction in accordance with CBC & CMC. UL 555 and UL 555S labels. Blades shall have metal-to-metal seals and not rely on actuator torque to maintain leakage rating. Prefco, Air Balance, Ruskin, Greenheck 5020-1 with 5800MB2 power open/spring close operator, or equal.

2.3 DUCTWORK INSULATION MATERIALS

A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50.

B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.

C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.

D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.4 PIPING MATERIALS

A. Refrigerant Piping:
1. Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. 95/ 5 tin-silver brazed joints. Provide schedule 40 PVC sleeve pipe for all below grade refrigerant piping. All piping shall be sized per equipment manufacturer requirements.
2. Valves and Specialties:
   a. Line Valves: Bronze body, ball type, TFE locked in seals. Back seated valve stem. Contromatics C-11.
   b. Filter-Drier: Replaceable core. Capacity in accordance with ARI Standard 710. Sporlan "Catch-All".
   c. Moisture Indicator-Sight Glass: Double port. Henry, Sporlan.
   d. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered. Suitable for system pressure. American, Flexonics.

B. Refrigerant Piping (Ductless Split System Multi-Zone):
1. Type ACR soft temper seamless copper, ASTM B280. Cast copper alloy fittings for flared copper tubes, ASME B16.26. Follow the Society of Automotive Engineers SAE J533 Standard-Flares for tubing. All piping shall be sized per equipment manufacturer requirements.
2. Valves and Specialties:
   a. Line Valves: Bronze body, ball type, TFE locked in seals. Back seated valve stem. Contromatics C-11.
   b. Filter-Drier: Replaceable core. Capacity in accordance with ARI Standard 710. Sporlan "Catch-All".
   c. Moisture Indicator-Sight Glass: Double port. Henry, Sporlan.
   d. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered. Suitable for system pressure. American, Flexonics.

C. Miscellaneous Piping Items:
1. Pipe Support:
   a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum loads per manufacturer's recommendation. Felt Lined, Kin-Line 450 F.
   b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple sections. Self-locking nuts and fittings. Kin-Line, Unistrut.
2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.

D. Flashing: Flashing for piping through roof shall be prefabricated 24 gage galvanized steel roof jacks with 8" square flange around pipe. Seal with weatherproofing mastic.

2.5 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Refrigerant Piping: Rubber based elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.25 Btu-in/hr-SF-degree F at mean temperature of 75 degrees F., 3/4" thick. Provide aluminum pipe and fitting jacketing. 0.016" thickness for straight pipe, 0.024" thickness for fittings with integral moisture barrier, pre-fabricated strapping and seals for piping exposed to weather, Childers, Pabco or equal.
1. Insulation shall be provided on both refrigerant lines for ductless split systems.

2.6 EQUIPMENT

A. General Requirements:
1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
3. Ratings:
   a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be CSA (US) certified, except that boilers shall be CSA (US) certified or UL listed.
   b. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
5. Electrical:
   a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
   b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
   c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design

on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.

d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.

6. Fan Selection:
   a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.
   b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
   a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
   b. Filter Media: 2" media. MERV 13. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP.
   c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/ - 2% of full scale. Range as required. Provide static pressure sensors, tubing, and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16- gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/ - 10%, selected at mid-range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable

rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

B. Variable Refrigerant Flow (VRF) Air Conditioning Specification – Heat Pump:

1. System Description:
   a. The variable capacity, heat pump air conditioning system shall be a Samsung, Toshiba, Daikin, Mitsubishi, Carrier, Trane or approved equal. Variable Refrigerant Flow Series (heat/cool model) split system. The system shall consist of multiple evaporators using PID control, and condensing unit. The outdoor units shall be a nominal 3 ton, 4 ton, or 5 ton direct expansion (DX), air-cooled heat pump air-conditioning system, inverter driven variable speed compressor, multi-zone split system, using R-410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 130% to that of the outdoor condensing unit capacity. All indoor units are each capable of operating separately with individual temperature control.
   b. The outdoor unit shall be interconnected to indoor unit and shall range in capacity from 7,500 Btu/h to 54,000 Btu/h in accordance with manufacturer's engineering data book detailing each available indoor unit. The indoor units shall be connected to the condensing unit utilizing manufacturer's specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable.
   c. Operation of the system shall permit either cooling or heating of all of the indoor units. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Touch Controller (ITC), an Intelligent Touch Manager (ITM) or a BMS interface.
2. VRF Features and Benefits:
   a. Voltage Platform: Heat pump condensing units shall be available in 208-230V/1/60 configurations.
   b. Advanced Zoning: A single system shall provide for up to 10 zones.
   c. Independent Control: Each indoor unit shall use a dedicated electronic expansion valve for independent control.
   d. VFD Inverter Control: Each condensing unit shall use a high efficiency, variable speed "inverter" compressor coupled with inverter fan motors for superior part load performance.
   e. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads.
   f. Indoor units shall use PID control to control superheat to deliver a comfortable room temperature condition.
   g. Variable Refrigerant Temperature (VRT) Control: Each condensing unit shall utilize an algorithm to automatically adjust the refrigerant suction and condensing temperatures in response to the heating and cooling loads, and in response to the current weather conditions. The VRT control shall be capable of being customized in the following modes and sub-modes:
      i. Automatic (factory preset): The Automatic VRT mode shall allow the target evaporator temperature (Te) and target condensing temperature (Tc) to float based on outdoor ambient temperature conditions, and shall incorporate the following sub-modes: Powerful, Quick, and Mild (factory preset).
      ii. High Sensible: The High Sensible mode shall allow the system Te and Tc values to be programmed to series of fixed Te and Tc values. The High Sensible mode shall also be capable of incorporating the following sub-mode: Eco.
      iii. Basic: The Basic mode shall disable the VRT control of the outdoor unit and allow the system to operate with constant Te and Tc values.
   h. Flexible Design:
      i. Linear piping distance between the condensing unit and furthest located indoor unit shall be per manufacturer's recommendations.

ii. Total “one-way” piping distance in the piping network shall be per manufacture’s recommendations.
iii. Vertical (height) separation between the condensing unit and the indoor unit units shall be per manufacturer’s recommendations.
iv. The outdoor unit shall connect an indoor evaporator capacity up to 130% of the outdoor condensing unit capacity.

i. Simple Wiring: Systems shall use 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.
j. Advanced Diagnostics: Systems shall include a self diagnostic, auto-check function to detect a malfunction and display the type and location.
k. Advanced Controls: Each system shall have at least one remote controller capable of controlling up to 16 indoor unit units.

3. Quality Assurance:
   a. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
   b. All wiring shall be in accordance with the National Electric Code (NEC).
   c. Each combination shall be rated in accordance with Air Conditioning, Heating and Refrigeration Institute’s (AHRI) Standard 210/240 and bear the AHRI label.
   d. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
   e. The outdoor unit will be factory charged with R-410A.
4. Delivery, Storage and Handling:
   a. Unit shall be stored and handled according to the manufacturer’s recommendations.
5. Standard Limited Warranty:
   a. Manufacturer shall warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ‘‘installation date’’ which is one of the two dates below:
      i. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit’s rating plate.
      ii. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.
6. Outdoor Unit:
   a. General: The outdoor unit is designed specifically for use with VRF series components.
      i. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a Daikin swing compressor, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separator, service ports and suction line accumulator. Liquid and suction lines must be individually insulated between the outdoor and indoor units.
      ii. The outdoor unit can be wired and piped with outdoor unit access from the left, right, rear or bottom.
      iii. The connection ratio of indoor units to outdoor unit shall be permitted up to 130%.
      iv. The outdoor system shall be able to support the connection of up to 10 indoor unit’s dependant on the model of the outdoor unit.
      v. The sound pressure level standard shall be that value as listed in the engineering manual for the specified models at 3 feet from the front of the unit. The outdoor unit shall be capable of operating automatically at further reduced noise during night time.
      vi. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
      vii. The outdoor unit shall allow for side-by-side installation with minimum spacing.

viii. The following safety devices shall be included on the condensing unit; high pressure switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
ix. To ensure the liquid refrigerant does not flash when supplying to the various indoor unit units, the circuit shall be provided with a sub-cooling feature.
x. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
xi. The outdoor unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls.

b. Unit Cabinet:
i. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

c. Fan:
i. The condensing unit fan(s) shall consist of propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter.
ii. The fan shall be a horizontal discharge configuration with a nominal airflow maximum range of 3,740 CFM.
iii. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
iv. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

d. Condenser Coil:
i. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
ii. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
iii. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube.
iv. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.

e. Compressor:
i. The compressor shall be variable speed controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.
ii. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed swing type.
iii. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
iv. The capacity control range shall be 14% to 100%.
v. The compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
vi. Oil separators shall be standard with the equipment together with an intelligent oil management system.
vii. The compressor shall be spring mounted to avoid the transmission of vibration.

f. Electrical:
i. The power supply to the outdoor unit shall be 208/230 volts, 1 phase, 60 hertz +/- 10%.
ii. The control voltage between the indoor and outdoor unit shall be 18VDC non-shielded, stranded 2 conductor cable.

iii. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.

7. Concealed Ceiling Ducted Unit:
   a. General: The indoor unit shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 72,000 Btu/h to 96,000 Btu/h. Indoor unit to be connected to outdoor unit heat pump. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with remote control. The indoor units sound pressure shall be 48 dB(A) at low speed measured 5 feet below the ducted unit.
   b. Performance: Each unit's performance is based on nominal operating conditions.
   c. Indoor Unit:
      i. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an adjustable external static pressure switch.
      ii. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
      iii. Both refrigerant lines shall be insulated from the outdoor unit.
      iv. The indoor units shall be equipped with a return air thermistor.
      v. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
      vi. The voltage range will be 253 volts maximum and 187 volts minimum.
   d. Unit Cabinet:
      i. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
      ii. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
   e. Fan:
      i. The fan shall be direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
      ii. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz, with a motor output of 0.51 HP.
      iii. The airflow rate shall be available in high and low settings.
      iv. The fan motor shall be thermally protected.
      v. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
   f. Coil:
      i. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
      ii. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
      iii. The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
      iv. The refrigerant connections shall be flare connections and the condensate will be 1-5/16 inch outside diameter PVC.
      v. A thermistor will be located on the liquid and gas line.
   g. Electrical:
      i. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

ii. Transmission (control) wiring between the indoor and outdoor unit shall be per manufacturer's recommendations.
iii. Transmission (control) wiring between the indoor unit and remote controller shall be per manufacturer's recommendations.

h. Control:
i. The unit shall have controls provided to perform input functions necessary to operate the system.
ii. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
iii. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

8. 4-Way Ceiling Cassette Indoor Unit:
a. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a four-way air distribution type, ivory white, impact resistant, and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
b. Acoustic Performance: The indoor units sound pressure shall range from 27 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.
c. Construction:
i. The indoor unit shall be completely factory assembled and tested. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, self-diagnostics, auto-restart function, 3 minute fused time delay, and test run switch.
ii. The 4-way supply airflow shall be field modifiable to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
iii. Return air shall be through the concentric panel, which shall include a filter.
iv. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 25" of lift.
v. The indoor units shall be equipped with a return air thermistor.
vi. The indoor unit shall be separately powered with 208-230V/ 1-phase/60Hz.
vii. The voltage range shall be 253 volts maximum and 187 volts minimum.
d. Unit Cabinet:
i. The cabinet shall be space saving and shall be located into the ceiling.
ii. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
iii. Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.
iv. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
e. Fan:
i. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
ii. The indoor unit shall operate with a power supply of 208/230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
iii. The airflow rate shall be adjustable and have high, medium and low fan settings.
iv. The fan motor shall be thermally protected.
f. Filter: The return air shall be filtered by means of a washable long-life filter with mildew proof resin.
g. Coil:
i. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

ii. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
iii. The refrigerant connections shall be flare connections and the condensate shall be 1-1/4 inch outside diameter PVC.
iv. A condensate pan shall be located under the coil.
v. A condensate pump with a 25 inch lift shall be located below the coil in the condensate pan with a built in high level safety alarm to shut down the unit.
vi. A thermistor shall be located on the liquid and gas line.

C. Exhaust Fans:
1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to the weather shall have ventilated weatherproof housing over motor and drive assembly.
2. Ceiling Fan: Ceiling mounted direct drive centrifugal exhaust fan with exhaust grille. Motor mounted on rubber-in-shear isolators. Motor and fan removable through grille. Acoustically lined housing. Backdraft damper. UL listed. Penn, Cook, ACME, Greenheck or equal.
3. In-Line Fan: Attic mounted direct drive centrifugal exhaust fan. Motor shall be open drip proof with permanently lubricated sealed bearings and built-in thermal overload protection and disconnect plug. Acoustic lined housing. Backdraft damper. UL listed. Provide 24”x24” access panel with cylinder key lock when above hard ceiling. Penn, Cook, ACME, Greenheck or equal.

PART 3 EXECUTION

3.1 DUCTWORK INSTALLATION

A. General:
1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards". Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
2. Seismic Bracing: All ducts shall be braced and supported per details on the drawings.
3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
5. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
6. Open ends of ductwork shall be covered during construction to keep inside clean.

B. Low Velocity-Low Pressure (up to 2000 ft/ min; up to 2.0 in. water):
1. Sheet Metal Ductwork:
a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
c. Duct Joints: Seal duct joints airtight with fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and watertight with duct mastic before closing and taping.
1) Where Ductmate type joints are used, the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.

d. Dampers: Install volume control damper and damper regulator in all branch ducts.
e. Duct dimensions shown on drawings for lined ducts, are clear net openings inside of lining.
f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rainwater to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.

2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft. Single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION

A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on drawings and manufacturer's instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

B. Fire Smoke Damper: Fire smoke dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.

C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

3.3 DUCTWORK INSULATION INSTALLATION

A. General: All supply and return sheet metal ductwork shall be insulated.

B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.

C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining. Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.4 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise unless specifically allowed by structural drawings and/ or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints and/or flexible connectors shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement.

2. Pipe Support:
   a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. No perforated straphanger shall be used in any work.
   b. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted, and erected before brazing. Install specified accessories. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70 degrees F. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment. Refrigerant piping below grade shall be run in 4” (min.) PVC conduit with long radius ells. Seal ends of conduit watertight.
   c. Flue Piping: Flue piping shall be installed in accordance with its UL listing and manufacturer's instructions. All welders shall be certified in accordance with AWS Standard D9.1, Specifications for welding sheet metal.
   d. PVC Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer’s recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

3.5 PIPING INSULATION INSTALLATION

A. Refrigerant Piping: Cover suction piping with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendation. Cover all fittings, unions, valves, and connections. Piping exposed to weather shall be covered with aluminum jacketing, seal all joints and seams with grey outdoor mastic or silver silicone sealant. Piping exposed in room shall be covered with piping chase painted to match wall.

3.6 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the contractor to ensure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.

B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.

C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer’s written instructions.

3.7 TEMPERATURE CONTROL SYSTEM

A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Carrier, Robertshaw or equal with sub-base capable of battery backup or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

3.8 SYSTEM AIR BALANCE

B. Scope: Provide services necessary to initially deliver the air quantities shown on the plans and finally to balance for uniform temperature in the spaces served. Adjust all elements in grilles and diffusers for proper air distribution and to minimize drafts. Submit final Air Balance Report for approval before final completion of the construction contract. Comply with SMACNA manual for the balancing and adjustment of air distribution systems.

C. As a minimum, the balance report shall include CFM and neck size at each supply, return and exhaust grille, total CFM and external static pressure for all air moving equipment, and name plate and actual motor amps for indoor air fans.

D. Scope: Provide the services of a qualified independent test and balance agency certified by the Associated Air Balance Council (AABC) or The National Environmental Balancing Bureau (NEBB) to test, adjust and balance, retest, and record performance of the system to obtain design quantities as specified. Balancing contractor must also be TABB certified.

E. Qualifications: Prior to commencing work, the agency shall be approved by the Owner's Representative.

F. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC standards.

G. Procedure: General: Balanced quantities shall be plus 10%, minus 10% of design quantities. All name-plate data, manufacturer, model, and serial numbers shall be recorded for each item tested. All outside air flow listed in minimum.

H. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Owner's Representative at his discretion may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Owner's Representative in making any tests he may require during this period of time.

I. Air Balance Procedure (for each Air Handling System):
1. All air filters shall be clean when air balance is performed.
2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
3. Adjust blower RPM to design requirements.
4. Record motor full load amperes.
5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
6. Record system static pressures, inlet, and discharge.
7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.
8. Adjust system for design CFM recirculated air.
9. Adjust system for design CFM outside air minimum settings.
10. Record entering air temperatures. (DB heating, DB and WB cooling.)
11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
12. Adjust all main supply and return air ducts to design CFM.
13. Adjust all zones to design CFM, supply, and return.
14. Adjust all diffusers, grilles, and registers to plus 10%, minus 0% of design requirements.
15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
16. Each grille, diffuser and register shall be identified as to location.

17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees downward deflection unless otherwise noted. Make a notation of any that are not set properly.
18. Size, type and manufacturer of diffusers, grilles, registers, and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts, dampers, or the addition of dampers cleaning of insect screens and replacement of filters required for correct balance as recommended by air balance agency, at no additional cost to Owner.
23. Set, test, and adjust packaged heating/ cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.

J. Water Balance Procedure:
1. Set valves for maximum coil flow.
2. Remove and clean all strainers.
3. Examine water in system and determine if water has been treated and cleaned.
4. Check expansion tanks to determine that they are properly charged, and that the system is completely full of water. Bleed air from system.
5. Adjust water flow through boilers, to design flow.
6. Record leaving and return water temperatures at boiler. Reset to correct design temperature.
7. Record the following at each coil:
   a. Inlet water temperatures.
   b. Leaving water temperatures.
   c. Pressure drop across coil.
   d. Pressure drop across bypass valve.
8. Record pump suction and discharge pressures at operating condition and with pump discharge valve completely closed.
9. Record running amperage of pump motor at operation condition and with pump discharge valve completely closed.
10. Record water metering device readings.

K. Test, adjust, and retest water bleed rates from evaporative coolers. Record all data.

L. Acoustic Performance Testing: Provide acoustic performance testing in accordance with the requirements of EQ3.0 of the "California Criteria for High Performance Schools, Best Practices Manual, 2009 Edition".
1. Maximum Background Noise Level: Unoccupied classrooms must have a maximum background noise level of no more than 45 dBA LAeq. The standard anticipates two primary noise sources, steady HVAC equipment noise and the usually unsteady exterior environmental noise. Where the measured ambient noises due to sources other than HVAC are within 5 dB of the measured overall noise (HVAC and exterior intrusive noise) a measurement of at least ½ hour duration shall be made in at least two classrooms in each building in the worst case (noisiest) locations on the school site

during normal school days and hours.

a. To evaluate the significance of intrusive exterior noise, a 30-minute Equivalent Sound Level (LAeq30, in general conformance with ANSI S12.60-2002, Annex E3) measurement shall be made in the classroom that is subjectively assessed to represent the worst case exposure to exterior noise, with the HVAC system not in operation. This Leq30 measurement shall be repeated with the HVAC in operation. If the second "HVAC-on" sound level is more than 5 dB greater than the initial "HVAC-off" measurement, exterior noise intrusion shall be deemed "not significant".
b. Where intrusive exterior noise has been deemed "not significant" short-term (15 second) A-weighted sound level measurements shall be made in each classroom with the HVAC systems in operation. Where exterior intrusive noise has been deemed "significant" (per the evaluation method noted above), LAeq30 sound level measurements shall be made in each classroom with the HVAC system in operation. In either case, where classrooms are served by variable-air-volume systems, the systems shall be operated at maximum nominal flow (typically by means of varying the thermostat set point).
c. Where exposure to exterior noise varies significantly between groups of classrooms (e.g. one side of a classroom wing adjacent to a street, the other side facing away), separate evaluations of exterior noise significance can be conducted to limit the need for LAeq30 measurements.

2. Maximum Reverberation: Classrooms less than 10,000 cubic feet must have a 0.6-second maximum (unoccupied) reverberation time and classrooms with volumes between 10,000 cubic feet and 20,000 cubic feet must have a 0.7-second maximum (unoccupied, furnished, and fitted-out) reverberation time. (ANSI Standard S12.60-2002). The reverberation times shall be measured in each classroom in three octave bands with center frequencies of 500, 1000, and 2000 Hz. The arithmetic average of the three measured values shall be compared to the standard.

END OF SECTION 23 00 01

SECTION 23 09 23 - DIRECT DIGITAL CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Heating and cooling piping:

1. Control valves
2. Flow meters
3. Flow switches
4. Press and temp sensor wells & sockets
5. Temp sensor wells and sockets

B. Duct accessories:

1. Airflow stations
2. BAS control dampers
3. Terminal unit controls

1.3 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. Communications with Third Party Equipment:

1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet interface for integration into the Direct Digital Control System described in this section (reference sequence of operations and points list for specifics). Those systems include:

a. Boilers
b. Chillers
c. Cooling Towers
d. Switchgear
e. Variable Speed Drives
f. Computer Room Units (MDF)

g. Rooftop Units

1.4 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.

B. The following sections constitute related work:

1. Division 01- General

2. Division 23 – Mechanical

3. Division 26 – Electrical

1.5 DESCRIPTION

A. General: The control system shall consist of a complete BAS system with a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphics. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface. If individual software seat licenses or keys are required provide a minimum of 4 additional licenses to accommodate multiple owner operators.

B. If manufacture offers a web-based BAS platform, the installing contractor shall provide the new web-based software and software updates required for this project. Additionally the installing contractor shall provide all computer related components (BAS web server – reference specifications for hardware requirements) for the new software platform to function in a peer-to-peer environment.

C. The system shall directly control HVAC equipment as specified in Sequences of Operation. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints.

D. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms specified shall be BACnet objects.

1.6 APPROVED CONTROL SYSTEMS

A. The following are approved control system suppliers, manufacturers, and product lines:

1. Cool Master Pro Universal VRF Gateway

1.7 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with Control System Manufacturer for a period of 10 years or greater. If the distributorship has not had duration of more than 10 years, the contractor will not be approved without the written approval prior to bid date (no exceptions).

2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

3. BAS Graphics shall be Three Dimensional Thermographic.

4. BAS provider shall warranty controllers for 5 years.

5. BAS Provider shall provide training to the owner at no additional cost for a duration of 5 years.

1.8 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authority's codes and ordinances for these plans and specifications. At a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)

2. International Energy Conservation Code (IECC)

3. International Building Code (IBC)

4. Uniform Mechanical Code (UMC)

5. ASHRAE Standard 135-2016: BACnet - A Data Communication Protocol for Building Automation and Control Networks

1.9 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 seconds.

2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 seconds and shall automatically refresh every 15 seconds.
3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 seconds.

4. Object Command. Devices shall react to command of a binary object within 2 seconds. Devices shall begin reacting to command of an analog object within 2 seconds.

5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 seconds.

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. Select execution times consistent with the mechanical process under control.

7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per second. Select execution times consistent with the mechanical process under control.

8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 seconds of other workstations.

9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.

Control Stability and Accuracy. Control loops shall maintain measured variable at set point within tolerances listed in Table 2.

Table1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±2ºF
Ducted Air	±2ºF
Outside Air	±2ºF
Dew Point	±3ºF
Water Temperature	±2ºF
Delta-T	±0.25ºF
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±0.1 in. w.g.
Air Pressure (space)	±0.01 in. w.g.
Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO_2)	±50 ppm

Note 1: 10% - 100% of scale
Note 2: For both absolute and differential pressure
Note 3: Not including utility-supplied meters

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±0.2 in. w.g. ±0.01 in. w.g.	0-6 in. w.g. -0.1 to 0.1 in. w.g.
Airflow	±10% of full scale	
Space Temperature	±2.0ºF	
Duct Temperature	±3ºF	
Humidity	±5% RH	
Fluid Pressure	±1.5 psi ±1.0 in. w.g.	1-150 psi 0-50 in. w.g. differential

1.10 SUBMITTALS

A. Product Requirements: Provide one electronic copy and 4 hard copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. If requested, provide drawings as AutoCAD 2017 and 4 prints of each drawing on 8.5 x 11 paper and 1 electronic copy of each drawing. When manufacturer's cut sheets apply to a product series rather than a specific product, **clearly indicate applicable data by highlighting** or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Provide submittals on the following:

1. Direct Digital Control System Hardware

   a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.

   b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:

      1. Direct digital controllers (controller panels)

      2. Transducers and transmitters

      3. Sensors (include accuracy data)

      4. Actuators

      5. Valves

      6. Dampers

      7. Relays and switches

      8. Control panels

      9. Power supplies

      10. Batteries

      11. Operator interface equipment

      12. Wiring

   c. Wiring diagrams and layouts for each control panel. Show termination numbers.

   d. Floor plan schematic diagrams indicating field sensor and controller locations.

   e. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Central System Hardware and Software

    a. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.

    b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

        1. Central Processing Unit (CPU) or web server

        2. Monitors

        3. Keyboards

        4. Power supplies

        5. Battery backups

        6. Interface equipment between CPU or server and control panels

        7. Operating System software

        8. Operator interface software

        9. Color graphic software

        10. Third-party software

    c. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.

    d. Network riser diagrams of wiring between central control unit and control panels.

3. Controlled Systems

    a. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.

    b. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.

    c. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.

    d. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified. Indicate alarmed and trended points.

4. Description of process, report formats, and checklists to be used in

Section 23 09 23 Article 3.15 (Control System Demonstration and Acceptance).

B. Schedules

1. Within two months of contract award, provide schedule of work indicating:

a. Intended sequence of work items

b. Start date of each work item

c. Duration of each work item

d. Planned delivery dates for ordered material and equipment and expected lead times

e. Milestones indicating possible restraints on work by other trades or situations

2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents. Submit 8 copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:

1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2017 and 6 prints of each drawing on 8 ½" x 11" paper.

2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of (Control System Demonstration and Acceptance).

3. Operation and Maintenance (O&M) Manual. Printed, electronic, or online help documentation of the following:

a. As-built versions of submittal product data.

b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.

c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.

d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.

e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.

f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic,

setpoints, tuning parameters, and objects can be viewed using furnished programming tools.

g. Graphic files, programs, and database on magnetic or optical media.

h. List of recommended spare parts with part numbers and suppliers.

i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.

j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.

k. Licenses, guarantees, and warranty documents for equipment and systems.

l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: The contractor shall provide training to owner personnel in a laboratory classroom environment. Each student shall be provided with a dedicated computer workstation utilizing a simulated BAS software platform that is installed for this project. The instructor's shall have CEU accreditation for all training courses offered. Provide documentation for this requirement in the initial BAS submittal. If contractor does not have CEU instructor or offer these courses locally include cost for tuition, travel and boarding to send students to manufacturer training facility. The owner shall receive free training for the life of the system.

1. Operator Overview – Consists of general system navigation, scheduling functions, setpoint modifications and parameter adjustments.

2. Advanced Topics Overview – Detailed analysis of trend setup/configuration, trend historian, alarm setup, alarm actions (email, printing, etc.), point renaming, and detailed analysis of equipment parameters.

3. Program/Logic Manipulation – Modify system programs as needed for additions and modifications.

4. Graphic Manipulation – Modify system graphics as needed for additions and modifications.

5. Hardware Troubleshooting – Classroom setup shall have HVAC mock-up systems. Operators shall be able to interact with this live system through the BAS utilized for this project. Class will provide students the ability to identify and repair common problems regularly encountered.

6. Software Troubleshooting - Classroom setup shall have HVAC mock-up systems. Operators shall be able to interact with this live system through the BAS utilized for this project. Class will provide students the ability to identify and repair common issues that can be utilized via software modifications.

7. Central Plant Operation – At a minimum the instructor shall thoroughly explain different types of central plant equipment and proper system modifications that can be made to enhance system performance and energy savings.

8. HVAC System Training – Objective of this class is to provide basic HVAC system knowledge of various types of systems including types of air side distribution and water side distribution. Topics such as thermodynamics, psychometrics, de-humidification, and demand control ventilation shall be thoroughly explained.

1.11 WARRANTY

A. Warrant work as follows:

1. Warrant materials for specified control system and peripheral control devices free from defects for a period of **3 years** after certificate of substantial completion. Warrant all labor for a period of **1 year** after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request. Additionally contractor shall offer 24/7 after-hours support to include alarm monitoring and associated dispatch service.

2. Provide graphic modifications for a period of 3 years from date of substantial completion. This shall include room number and equipment modifications as requested by the owner.

3. Provide telephone support free to the owner for a period of 3 years after substantial completion. This service includes technical support for all BAS equipment and shall include troubleshooting and problem resolution via the telephone or web services. Service shall be available during the hours of 7am to 5pm Monday – Friday.

4. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

5. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor or Owner identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

6. Exception: Contractor shall not be required to warranty existing devices except those that have been rebuilt or repaired during installation.

1.12 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics

2. Record drawings

3. Database

4. Application programming code

5. Documentation

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE/ANSI Standard 135-2016, BACnet.

B. Use existing Ethernet backbone for network segments marked "existing" on project drawings.

C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.

2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Sequence of Operations. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

E. Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.

F. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

G. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable the system to both read and write data.

1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or

binary value software points) from any system controller or from the trend history database.

2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.

3. For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.

2.3 OPERATOR INTERFACE

A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. Existing manufacturer's BAS web server and workstation can be utilized. In addition to the primary operator interface, the system shall include a secondary interface compatible with a locally available commercial wireless network and viewable on a commercially available wireless device such as a Wireless Access Protocol (WAP) enabled cellular telephone or personal digital assistant (PDA). This secondary interface may be text-based and shall provide a summary of the most important data. As a minimum, the following capabilities shall be provided through this interface:

1. An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.

2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.

3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.

4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.

B. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135-2016, BACnet Annex J.

C. Hardware. If providing a new server, each workstation or web server shall consist of the following:

1. Hardware Base. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified in Section 23 09 23 Paragraph 1.8. Hard disk shall have sufficient memory to store system software, one year of data for trended points specified in Sequences of Operation, and a system database at least twice the size of the

existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance. Web server shall be Compaq Rack Mounted Server (or equal) with a minimum of:

a. Dual Processor Intel Pentium 3.66 GHz processor

b. 1 GB RAM

c. 80 GB hard disk providing data at 100 MB/sec

d. RAID 5 Configuration

e. 128x CD-ROM drive

f. Most Current Windows Server Operating System

g. Serial, parallel, and network communication ports and cables required for proper system operation.

2. If providing a server the server shall support one or more the following database types:

a. SQL Server 2012 R2
b. PostgreSQL
c. MySQL
d. MS Access

D. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1. Log In and Log Out. System shall require user name and password to log in to operator interface.

2. Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.

3. View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.

4. View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.

5. View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.

6. View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.

7. View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.

8. Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.

9. Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

E. System Software.

1. Operating System: Web server or workstation shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows XP Pro, Red Hat Linux, or Sun Solaris.

2. System Graphics: Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint. Graphics shall

a. Functionality: Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

b. Animation: Graphics shall be able to animate by displaying different image files for changed object status.

c. Alarm Indication: Indicate areas or equipment in an alarm condition using color or other visual indicator.

d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

F. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller

firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. Operators shall be able to configure the system.

4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.

5. Security. System shall require a user name and password to view, edit, add, or delete data.

    a. Operator Access. Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.

    b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.

    c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

6. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 93.Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

8. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.

9. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.

11. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to

archive data to the hard disk. The contractor shall configure all physical control points and software control points to accumulate trend data. Analog values shall be configured utilizing time-based intervals and digital values shall be configured for COV. Provide at a minimum of 250 samples per control point. If data can be stored locally at the controller level this information shall be archived at the central server or all BAS workstations.

12. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

14. Standard Reports. Furnish the following standard system reports:

    a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.

    b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.

    c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:

        1. Alarm History.

        2. Trend Data. Operator shall be able to select trends to be logged.

        3. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

15. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

16. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.

17. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.

18. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

a. Language. Language shall be graphically based or English language oriented. If graphically based, language shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks. If English language oriented, language shall be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and shall allow for free-form programming that is not column-oriented or "fill-in-the-blanks."

b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

g. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.

1. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

2. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

19. BACnet. Web server or workstation shall have demonstrated interoperability during at least one BMA Interoperability Workshop and shall substantially conform to BACnet Operator Workstation (B-OWS) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L.

2.4 CONTROLLER SOFTWARE

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. System Security. See Paragraph 2.3.F.5 (Security) and Paragraph 2.3.F.14.c.3 (Operator Activity).

C. Scheduling. See Paragraph 2.3.D.4 (View and Adjust Operating Schedules). System shall provide the following schedule options as a minimum:

1. Weekly. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).

2. Exception. Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.

3. Holiday. Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

D. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

E. Binary and Analog Alarms. See Paragraph 2.3.F.7 (Alarm Processing).

F. Alarm Reporting. See Paragraph 2.3.F.9 (Alarm Reactions).

G. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

H. Maintenance Management. System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in Section 23 09 93.

I. Sequencing. Application software shall sequence chillers, boilers, and pumps as specified in Section 23 09 93.

J. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.

K. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

L. Energy Calculations.

1. System shall accumulate and convert instantaneous power (kW) or flow rates (gpm) to energy usage data.

2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

3. System shall calculate a fixed-window average. Window interval start shall be defined by utility meter digital input signal to synchronize system's and utility's fixed-window averages.

M. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

N. On and Off Control with Differential. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.

O. Runtime Totalization. System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified.

2.5 CONTROLLERS

A. General. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Smart Actuators (SA) as required to achieve performance specified in Section 23 09 23 Article 1.8 (System Performance).

B. BACnet.

1. Building Controllers (BCs). Each BC shall have demonstrated interoperability during at least one BMA Interoperability Workshop and shall substantially conform to BACnet Building Controller (B-BC) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L.

2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.

3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.

4. Smart Actuators (SAs). Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.

5. BACnet Communication.

a. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.

b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.

c. Each AAC and ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

d. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

C. Communication.

1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.

2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.

3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.

4. Stand-Alone Operation. Each piece of equipment specified in Sequences of Operation shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

D. Environment. Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -20°F to 140°F.

2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 32°F to 120°F.

E. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

F. Serviceability.

1. Controllers shall have diagnostic LEDs for power, communication, and processor.

2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.

3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Memory.

1. Controller memory shall support operating system, database, and programming requirements.

2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.

3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

H. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft.).

I. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall send a pulsed low-voltage signal for pulse width modulation control or an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. Pulse-Width Modulation. Control actuators designed for pulse-width modulation with a single binary output that cycle with variable on and off times as determined by the application software. Pulse-width modulation may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

J. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

    a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.

    b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:

    a. Dielectric strength of 1000 V minimum

    b. Response time of 10 nanoseconds or less

    c. Transverse mode noise attenuation of 65 dB or greater

    d. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.8 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers.

1. Type. Control dampers shall have linear flow characteristics and shall be parallel- or opposed-blade type as specified below or as scheduled on drawings.

    a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.

    b. Other modulating dampers shall be opposed-blade.

    c. Two-position shutoff dampers shall be parallel or opposed-blade with blade and side seals.

2. Frame. Damper frames shall 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.

3. Blades. Damper blades shall not exceed 8 inches in width or 48 inches in length. Blades shall be suitable for medium velocity (2000 fpm) performance. Blades shall be not less than 16 gauge.

4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.

5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than (10 cfm per ft ^{2}) at (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of (1500 fpm).

6. Sections. Damper sections shall not exceed 48 in. - 60 in.. Each section shall have at least one damper actuator.

7. Linkages. Dampers shall have exposed linkages.

B. Electric Damper and Valve Actuators.

1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.

2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).

3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range.

4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.

5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 inch -.lb torque capacity shall have a manual crank.

6. Acceptable Manufacturers:

a. Belimo

C. Control Valves.

1. General. Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown.

2. Type. Provide two or three-way control valves for two-position or modulating service as shown.

3. Water Valves.

a. Valves providing two-position service shall be quick opening. Two-way valves shall have replaceable disc or ball.

b. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide the following minimum close-off pressure ratings.

1. Two-way: 100% of total system (pump) head.

2. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

c. Ports. Valves providing modulating service shall have equal percentage ports.

d. Sizing.

1. Two-position service: line size.

2. Two-way modulating service: select pressure drop equal to the greatest of twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35 kPa (5 psi).

3. Three-way modulating service: select pressure drop equal to the smaller of twice the pressure drop through the coil exchanger (load) or 35 kPa (5 psi).

e. Fail Position. Water valves shall fail normally open or closed as follows unless otherwise specified.

1. Water zone valves: normally closed.

2. Heating coils in air handlers: normally closed.

3. Chilled water control valves: normally open.

4. Other applications: as scheduled or as required by sequences of operation.

f. Acceptable Valve and Actuator Manufacturers:

1. Belimo

4. Steam Valves.

a. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide minimum close-off pressure rating equal to 150% of operating (inlet) pressure.

b. Ports. Valves providing modulating service shall have linear ports.
c. Sizing.

1. Two-position service: select pressure drop equal to 10%-20% of inlet psig.

2. Modulating service at 100 kPa (15 psig) or less: select pressure drop equal to 80% of inlet psig.

3. Modulating service at 101-350 kPa (16-50 psig): select pressure drop equal to 50% of inlet psig.

4. Modulating service at over 350 kPa (50 psig): select pressure drop as scheduled on drawings.

D. Binary Temperature Devices.

1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented ABS plastic cover.

2. Line-Voltage Space Thermostats. Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented ABS plastic cover.

3. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 20 ft long. Element shall sense temperature in each 1 ft section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

E. Temperature Sensors.

1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.

2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 5 ft in length per 10 ft ^{2} of duct cross-section.

3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.

4. Space Sensors: Space sensors shall be stainless steel flush plate mounted type.

5. Differential Sensors. Provide matched sensors for differential temperature measurement.

F. Humidity Sensors.

1. Duct and room sensors shall have a sensing range of 20%-80%.

2. Duct sensors shall have a sampling chamber.

3. Outdoor air humidity sensors shall have a sensing range of 20%-95% RH and shall be suitable for ambient conditions of 40°F-170°F.

4. Humidity sensors shall not drift more than 1% of full scale annually.

G. Flow Switches. Flow-proving switches shall be thermal dispersion type (IFM U 40100 or approved equal) or differential pressure type (air or water service). Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).

1. Thermal dispersion type switches shall have relay output, wire break output and temperature output.

2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 4 enclosure unless otherwise specified.

H. Relays.

1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

I. Override Timers.

1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0-6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.

J. Current Transmitters.

1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.

2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.

3. Unit shall be split-core type for clamp-on installation on existing wiring.

K. Current Transformers.

1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.

2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.

3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

L. Voltage Transmitters.

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.

2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.

3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

M. Voltage Transformers.

1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.

2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.

3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

N. Power Monitors.

1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.

2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

O. Current Switches.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

P. Pressure Transducers.

1. Transducers shall have linear output signal and field-adjustable zero and span.

2. Continuous operating conditions of positive or negative pressure 50% greater than calibrated span shall not damage transducer sensing elements.

3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 4-20 mA output, suitable mounting provisions, and block and bleed valves.

4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300 psi.) Transducer shall have 4-20 mA output, suitable mounting provisions, and 5-valve manifold.

Q. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

R. Pressure-Electric (PE) Switches. PE switches shall be UL listed, pilot duty rated (125 VA minimum) or motor control rated, metal or neoprene diaphragm actuated, operating pressure rated for 0-175 kPa (0-25 psig), with calibrated scale minimum setpoint range of 14-125 kPa (2-18 psig).

1. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application.

2. Switches shall be open type (panel-mounted). Exception: Switches shall be enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.

3. Each pneumatic signal line to PE switches shall have permanent indicating gauge.

S. Carbon Monoxide Detector / Controller / Transducer requirements:

1. Approved Manufactures:

   a. U.S. Draft Co.; Model CGM-505

2. Shall comply with Texas State Boiler code 65.603-2015.

3. ETL Listed to UL61010-1, CAN/CSA C22.2 No 61010-1, and LADBS Approved.

4. Boilers shall be individually hard wired.

5. Shall carry a (2) two year warranty.

6. Shall be calibrated every (18) eighteen months and a record of calibration shall be posted in a conspicuous place.

7. Shall be capable of displaying from 0-200 ppm of CO.

8. NEMA 1 enclosure.

9. Provide expansion board for additional equipment interlocks.

10. Provide pre-programmed dry contacts to shut down equipment during unsafe operation.

11. Fan relay actuation selectable with output for fan relay, alarm relay and 4-20ma signal.

12. Provide digital display, buzzer, fan delay.

13. Fan runtime shall have minimum.

14. Fan relays shall be pilot duty, SPDT, latching or non-latching at 5A, 240 VAC.

15. 0-10 VDC control signal out, visual alarm and audible alarm.

16. Alarm relay rating for 0.5A, 120V, 60VA.

17. Operating Environment from 0ºF to 125ºF at 10 to 90% RH.

T. Local Control Panels.

1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.

2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection

terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.

3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

2.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 09 23 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 PROTECTION

A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site.

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.

2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Submittals. See Section 23 09 23 Article 1.9 (Submittals).

C. Test and Balance.

1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.

2. Train Test and Balance Contractor to use control system interface tools.

3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.

4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

D. Life Safety.

1. Duct smoke detectors required for air handler shutdown are provided and wired under Division 26.

2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23 and wired by Division 26.

3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 26.

E. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.

1. Communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).

2. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation described regardless of where within the contract documents those products are described.

3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.

4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.5 FIELD QUALITY CONTROL

A. Commissioning and start-up of the BAS system shall be performed factory certified employees of the BAS contractor or manufacturer. Under no instances shall electrical subcontractors perform this work.

B. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.7 (Codes and Standards).

C. Continually monitor field installation for code compliance and workmanship quality.

D. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.6 WIRING

A. To differentiate BAS wiring from that of other trades, all cable except for underground will have a **yellow outer jacket** (no exceptions).

B. Division 26 contractor shall supply a dedicated 120vac power to a junction box in each mechanical room for use by the BMCS.

C. A Conduit fill based on plenum 18 gauge 2 conductor:

1. 1/2 inch - No more than 4 conductors.

2. 3/4 inch - No more than 8 conductors.

3. 1 inch - No more than 12 conductors.

D. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 23 differ from Division 26, Section 23 09 23 shall take precedence.

E. All wires whether control network or device wire shall be marked with Brady-type markers.

F. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

G. Low-voltage wiring shall meet NEC Class 2 requirements. Sub-fuse low-voltage power circuits as required to meet Class 2 current limit.

H. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

I. Install wiring in raceway where subject to mechanical damage and at levels below 10ft. in mechanical, electrical, or service rooms.

J. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

K. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

L. Do not install wiring in raceway containing tubing.

M. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at (5 ft) intervals.

N. Contractor shall install all low voltage communication wiring as per all TIA/EIA communication cabling standards. All cabling shall be installed in dedicated cabling support such as j-hook, d-rings, or saddles. All supports shall be supported directly from building structure. Do not support cabling or supports from ceiling grid wire, conduit, ductwork, piping, or other system cabling. All cabling must be installed in independent support for that given system and may not share supports or run in same conduit or support. All cabling shall be supported every 5'-0" from approved cabling support method. Contractor shall bundle all system cabling and label all wiring for system they serve. All cabling passing thru walls shall require dedicated conduit sleeves with bushing to protect cabling during installation. Contractor shall provide 1 meter service loops at all device termination locations and 3 meter service loops at all head end termination locations. All low voltage HVAC control cabling shall be yellow in color unless specified otherwise. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

O. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

P. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

Q. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

R. Use color-coded conductors throughout.

S. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

T. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

U. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

V. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

W. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft.) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size.

Y. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.7 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

G. Label communication wiring to indicate origination and destination.

H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.8 FIBER OPTIC CABLE

A. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

3.9 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 1 ft. of sensing element for each 1 ft. ^{2} of coil area.

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall at designated location with sun shield.

I. Differential Air Static Pressure.

1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.

4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.

5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.

6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.

J. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.10 FLOW SWITCH INSTALLATION

A. Adjust flow switch according to manufacturer's instructions.

3.11 ACTUATORS

A. General. Mount actuators and adapters according to manufacturer's recommendations.

B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.

1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten linkage.

3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

4. Provide necessary mounting hardware and linkages for actuator installation.

3.12 IDENTIFICATION OF HARDWARE AND WIRING

A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.

B. Label pneumatic tubing at each end within 5 cm (2 in.) of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show instrument or item served.

D. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

E. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.

F. Label valves with nameplates.

G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

H. Label identifiers shall match record documents.

3.13 PROGRAMMING

A. Point Naming. Name points as shown on the equipment points list provided with each Sequence of Operation. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.

B. All DDC programming shall be accomplished through graphical programming, line code is unacceptable

C. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented.

1. Application Programming. Provide application programming that adheres to sequences of operation specified in Section 23 09 93. Program documentation or comment statements shall reflect language used in sequences of operation.

2. System Programming. Provide system programming necessary for system operation.

D. Operator Interface.

1. Standard Graphics. Provide graphics as specified in Section 23 09 23 Article 2.3 Paragraph E.2 (System Graphics). Show on each equipment graphic input and output points and relevant calculated points such as indicated on the applicable Points List located in the Sequence of Operation. Point information on graphics shall dynamically update.

2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation) as described in Section 23 09 23.

3. DDC screen graphic room numbers shall be based on final room graphics package. Obtain Architect/Owner approval of final room numbers prior to programming.

3.14 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.

1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 23.

2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.

3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.

4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.

5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.

6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.

7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.

8. Alarms and Interlocks.

   a. Check each alarm with an appropriate signal at a value that will trip the alarm.

   b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.

   c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.15 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to

tests specified in Article 3.15 (Control System Checkout and Testing). Provide Engineer with log documenting completion of startup tests.

1. Preliminary Review: At least 7 days prior to on-site demonstration, provide read-only username and password to Engineer for preliminary system review to be performed remotely. Engineer will review to verify all systems are connected and communicating and all points are reading properly and graphics are complete. The Engineer will provide a report of any deficiencies. The contractor shall correct all deficiencies prior to on-site demonstration.

2. On-site Demonstration: Engineer, Owner, contractor(s) and any/all factory authorized equipment representatives shall be present to perform, observe and review system demonstration. Notify Engineer/Architect at least 10 days before system demonstration is scheduled.

    a. Demonstration shall follow process submitted and approved under Section 23 09 23 Article 1.9 (Submittals). Complete approved checklists and forms for each system as part of system demonstration.

    b. Demonstrate actual field operation of each sequence of operation as specified in Section 23 09 93. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Engineer. Provide and operate test equipment required to prove proper system operation.

    c. Demonstrate compliance with sequences of operation through each operational mode.

    d. Demonstrate complete operation of operator interface.

    e. Demonstrate each of the following.

    f. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. Engineer will require further tuning of each loop that displays unreasonably under- or over-damped control.

    g. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand-limiting setpoint, and status of setpoints and other affected equipment parameters.

    h. Building fire alarm system interface.

    i. Trend logs for each system. Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation in Section 23 09 93. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be

retrievable for use in other software programs as specified in Section 23 09 23 Article 2.3 Paragraph F.11 (Trend Configuration).

3. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

B. Acceptance.

1. After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Engineer will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.

2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in Section 23 09 23 Article 1.9 (Submittals).

3.16 CLEANING

A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.

B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.

C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.17 SUPPLEMENTAL OPERATIONAL SOFTWARE

A. Utility reporting Software

1. Scope of Work: Power monitoring will be accomplished by accessing existing ERCOT grade revenue metering and/or by the installation of a separate power meter/switch gear interface. Write programming for server based data extraction software. Install software onto Web-Access server. Verify and commission program functionality from the central site computer. Utility reporting will monitor and record consumption at user definable increments. Utility reporting will generate reports based on user definable timeframes. Monitoring Data shall be extracted from the server, through the World Wide Web, via xml / SOAP. Data shall be collected at 15-minute intervals. Data shall be assimilated in a user definable format, reflecting, at a minimum, the following values, per building, per user definable time frame:

a. KW

b. KWh

c. Plant run times

d. Outside Air Temperature

2. Facility data shall be input to the database. This data shall be assimilated by the BAS contractor by site survey. Data from drawings or schedules is unacceptable on its own, and must be field verified.

    a. Building square footage

    b. Building population

    c. Current electric utility rate structure

3. Reports shall be generated which configure the data in a user-friendly format. All reports shall be easily sorted to identify excessive energy consumption. User definable alarm thresholds shall be enabled. Data, and alarm thresholds shall be normalized for degree-days. At a minimum, the reports will consist of the following:

    a. Budget Report - Comparative analysis of budgeted energy costs versus actual energy costs.

    b. Trend Report - Trend KWH for each day of a user defined period. Display in graphic format.

    c. Board Report - Data is sorted by the following criteria: facility type, raw KWH, KWH per square foot, cost per square foot, and cost per occupant and plant runtime accumulation.

    d. ECM report - Comparative data based on consumption history before, and consumption history after, an Energy Conservation Measure is executed

    e. Summary Report - All report data shall be assimilated in this single report.

B. Power Meter Monitoring Service

1. Scope of Work: During the Warranty Period, the BAS contractor will provide a supplemental monitoring service to assure the optimization of the Power Meter Monitoring Service. The Power Meter Monitoring Service shall be continually utilized to identify Energy Conservation Measures. BAS Contractor will apply the following resources to this service:

    a. Certified energy Manager (CEM)

    b. Engineering and software support

    c. Daily inspections from the BAS Contractor help desk

    d. Regular field inspections by BAS Contractor technicians

2. Requirements of this contract require the BAS contractor to perform the following requirements.

    a. Establish alarming thresholds and building benchmark

    b. Receive all alarms if weekly thresholds are exceeded.

c. Perform a regular data extraction.

d. Identify to owner any instances where the alarm threshold has been exceeded.

e. Perform a preliminary analysis and remediate where possible.

f. Continually search for opportunities in the way of energy curtailment measures (ECMs).

g. Publish a monthly report, complete with analysis and recommendation for ECMs, presented in both hardcopy and digital media.

END OF SECTION 23 09 23

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SUMMARY

A. Provide all work for electrical systems required in the project to be properly installed, tested, and performing their intended function.

1.2 QUALITY ASSURANCE

A. Perform all work in accordance with the latest edition of the California Electrical Code.

B. All electrical materials and distribution, and utilization equipment shall be UL Listed.

C. All equipment and materials shall be new and unused and of United States Domestic manufacture unless approved otherwise by engineer or owner.

D. Eliminate any abnormal sources of noise that are considered by the architect not to be an inherent part of the electrical systems as designed.

1.3 COORDINATION WITH OTHER TRADES

A. Coordinate the work of this division with all other divisions to ensure that all components of the electrical system will be installed at the proper time and fit the available space.

B. Locate and size all openings in work of other trades required for the proper installation of the electrical system components.

C. Make all electrical connections to all equipment furnished by this division and any other division.

D. Make all electrical connections from all 120 volt and greater dampers and switches to associated exhaust fan(s) furnished by any other division.

1.4 DRAWINGS

A. The drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Determine exact locations by review of equipment manufacturer's data, by job site measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The size of the electrical equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed manufacturers will be acceptable, it is the responsibility of the Contractor to determine if the equipment that Contractor proposes to furnish will fit in the space. The drawings are not intended to show exact locations of conduit and wire, or to indicate all wire terminators, connectors, conduit fittings, boxes or supports, but rather to indicate distribution, circuitry, and control.

B. The Electrical Drawings are necessarily diagrammatic in character and cannot show every connection in detail or conduit in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor

shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. When the mechanical and electrical Drawings do not give exact details as to the elevation of pipe, conduit, and ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Exposed conduit is generally intended to be installed true and square to the building construction and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

1.5 SUBMITTALS

A. Specification Review:
   1. Include a paragraph-by-paragraph written specification review for each product listed requiring a submittal. Denote any proposed deviations from specifications.

1.6 EXISTING CONDITIONS

A. Do all work required to maintain electrical services to the Owner occupied portions of the building during construction.

B. No connection to existing services or utilities shall be made without Owner's knowledge and permission. All such connections shall be planned and scheduled to minimize the length of service interruption required. Request for shutdown shall be made to Owner at least two (2) weeks in advance and shall be accompanied by detailed written schedule of activities during shutdown and list of materials required for connection and renewal of service. It shall be understood that all such service interruptions shall be made at the Owner's convenience, not the Contractor's. No increase in contract amount will be allowed for reasons of premium time, inefficiency of operations or other considerations not calculated in original bid.

C. All items removed shall be stored on-site. Schedule a review of the items with the Owner. Remove from site all items the Owner does not choose to keep. Deliver Owner designated items to Owner's storage facility.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

PART 2 EXECUTION

2.1 EXISTING WORK

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary wiring and connections to maintain existing systems in service during construction.

C. When performing work on energized equipment or circuits, use personnel experienced and trained in similar operations.

D. Remove, relocate, and extend existing installations to accommodate new construction.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

2.2 OWNER INSTRUCTION

A. Provide on-site Owner training for all new equipment.

B. Use Operation and Maintenance manuals and actual equipment installed as basis for instruction.

C. At conclusion of on-site training program have Owner personnel sign written certification they have completed training and understand equipment operation. Include copy of training certificates in final Operation and Maintenance manual submission.

D. Supply record drawings to the district in PDF and the latest version of AutoCAD.

END OF SECTION 26 05 00

SECTION 26 05 01 – SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Divisions 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This section includes:
   1. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor to walk job to observe existing conditions and account for variance as needed.

B. Verify field measurements and circuiting arrangements as shown on drawings.

C. Verify that abandoned wiring and equipment serve only abandoned facilities.

3.2 PREPARATION

A. Disconnect electrical systems as required under this contract.

B. Coordinate work with the district. No demolition work shall begin without the district's approval.

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: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. 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.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted, or alternate arrangements have been made with owner (e.g. – Fire Watch). Disable system only to make switchovers and connections. Coordinate outages with Owner and local fire service. 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.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system to make switchovers and connections. 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.

3.3 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. Electrical Contractor is responsible for demolishing electrical materials and shall remove from the site and dispose properly or recycle.

D. Remove abandoned wiring to source of supply.

E. Remove exposed abandoned conduit. Cut conduit flush with walls and floors, and patch surfaces as required to match existing.

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. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 INSTALLATION

A. Install relocated and replacement materials and equipment as shown.

END OF SECTION 26 05 01

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Wires and cables rated for 600 volts or less.
   2. Connectors, splices, and terminations rated for 600 volts or less.
   3. Lugs and pads rated for 600 volts or less.

B. System Description:
   1. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

C. Reference Standards:
   1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
   2. National Electrical Manufacturers Association (NEMA):
      a. WC 70 Power Cables Rated 2,000 V or Less for the Distribution of Electrical Energy.
   3. National Electrical Testing Association (NETA):
      a. ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   4. Underwriters Laboratories, Inc. (UL):
      a. 83 UL Standard for Safety Thermoplastic-Insulated Wires and Cables.
      b. 486 Standard for Wire Connectors.
   5. American Society for Testing and Materials (ASTM):
      a. B1 Standard Specification for Hard-Drawn Copper Wire.
      b. B3 Standard Specification for Soft or Annealed Copper Wire.
      c. B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

1.3 SUBMITTALS

A. Provide product data for the following equipment:
   1. Wires.
   2. Cables.
   3. Connectors.
   4. Lugs.
   5. Splice Kits.

B. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Confirm to requirements of the CEC, latest adopted version.
   2. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wires and Cables:
1. Southwire Company
2. Encore Wire Corporation
3. Cerro Wire and Cable Co.
4. General Cable Corp.; a brand of Prysmian Group
5. Okonite Co.
6. Alan Wire
7. LS Cable and System USA
8. American Wire and Cable

B. Connectors:
1. FCI Burndy Corp.
2. Cooper Crouse Hinds.
3. O.Z./ Gedney Co.
4. Thomas & Betts Co.
5. 3-M Co.
6. Ideal Industries Co.
7. Polaris Electrical Connectors
8. ILSCO

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.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS.

A. Wire and Cable Shall Be:
1. Copper, 600 volt rated throughout. Conductors 12AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
2. 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.

B. Each phase wire shall be uniquely color-coded as indicated below:
1. 120/ 240 Volts
   Phase A – Black
   Phase B – Red
   Neutral – White
   Ground – Green
2. 120/ 208 Volts
   Phase A – Black
   Phase B – Red

Phase C – Blue
Neutral – White
Ground – Green

3. 277/ 480 Volts
   Phase A – Brown
   Phase B – Orange
   Phase C – Yellow
   Neutral – White or Natural Gray
   Ground – Green
4. Isolated Grounds: Green with Yellow Stripes

C. 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 (i.e., waterproof, wet location, plenum, temperature rated). 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.

D. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.

E. Refer to signal and communications specification sections for cable requirements.

2.3 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.

2.4 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

3.1 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. 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. See Section 26 05 53: Identification of Electrical Systems.

D. 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.

E. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.

F. Cable and conductors routed through pull boxes and vaults shall be properly supported. 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 (e.g. – Fire alarm and communications systems, as defined in their respective specifications sections and/ or drawings).
      b. Provide all required conductors for a fully operable system.
   3. Provide dedicated neutrals (one neutral conductor for each phase conductor). Exceptions may only be granted with Electrical Engineer approval.
   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.

3.2 FIELD QUALITY CONTROL

A. Field inspection and test shall be performed under provisions of NETA ATS section 7.3 (2) - Low Voltage Cables, 600-Volt Maximum as follows:
   1. Visual and Mechanical Inspection:
      a. Compare cable data with drawings and specifications.
      b. Inspect exposed sections of cable for physical damage and correct connection in accordance with single-line diagram.
      c. Inspect all bolted electrical connections for high resistance using one of the following methods:
         1) Use of low-resistance ohm-meter in accordance with NETA section 7.3.2.2 (Electrical Tests).

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data from NETA ATS Table 10.12.

d. Inspect compression-applied connectors for correct cable match and indentation.
e. Verify cable color coding with applicable specifications and CEC.

2. Electrical Tests
   a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Test duration shall be one minute.
   b. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable, in accordance with Section 7.3.2.1 (Visual and Mechanical Inspection).
   c. Perform continuity test to insure correct cable connection.
   d. Correct malfunctions and/ or deficiencies immediately as detected at no additional cost to the District, including additional verification testing.
   e. Subsequent to final wire and cable terminations, energize all circuitry and demonstrate functional adequacy in accordance with system requirements.
3. Test Values
   a. Compare bolted connection resistance to values of similar connections.
   b. Bolt-torque levels should be in accordance with NETA ATS Table 10.12 unless otherwise specified by the manufacturer.
   c. Micro-ohm or milli-volt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer’s published data. If manufacturer’s data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
   d. Minimum insulation-resistance values should not be less than 50 meg-ohms.
   e. Investigate deviations between adjacent phases.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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 Sections:
   1. Section 26 05 00: Common Work Results for Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.

C. Reference Standards:
   1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
   2. Institute of Electrical and Electronics Engineers (IEEE):
      a. 81 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
      b. 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems.
      c. 1100 Recommended Practice for Powering and Grounding Electronic Equipment
   3. National Electrical Testing Association (NETA):
      a. ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
   4. Underwriters Laboratories, Inc. (UL):
      a. 83 UL Standard for Safety Thermoplastic-Insulated Wires and Cables.
      b. 467 Grounding and Bonding Equipment.
   5. American Society for Testing and Materials (ASTM):
      a. B1 Standard Specification for Hard-Drawn Copper Wire.
      b. B3 Standard Specification for Soft or Annealed Copper Wire.
      c. B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

PART 2 PRODUCTS

2.1 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.

2.2 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).

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper; 3/4 inch by 10 feet (19 mm by 3 m).

B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches (300 mm) deep, with cover.
   1. Install at least one test well for each service unless otherwise indicated. Install the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

PART 3 EXECUTION

3.1 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.

3.2 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.

3.3 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 the various grounding conductors.

D. Switchgear, Switchboards, and Motor Control Centers:
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 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. Nonmetallic 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 power wires 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.

3.4 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.

3.5 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system. Refer to communications backbone cabling specification section.

3.6 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 15 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met, and test results shall be submitted to the Owner with final close out documents.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of- potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the Inspector of Record (IOR) prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.

D. Furnish a copy of tests to Owner at completion of project.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 01, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.2 REFERENCES

A. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to Building Code and UL for fire resistance ratings and surface burning characteristics.

1.5 SUBMITTALS

A. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the Building Code.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. Electroline Manufacturing Company.

3. O-Z Gedney Co.
4. Appleton.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking. With Stainless tooth.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems.
3. Midland Ross Corporation, Electrical Products Division.
4. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Sleeves for raceway Through Non-fire Rated Floors: 18 gage galvanized steel.

B. Sleeves for raceway Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

C. Sleeves for raceway Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL Listed.

D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 SPRING STEEL CLIPS

A. Product Description: Mounting clamp, and screw.

2.5 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. NMP Corporation.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Manufacturers:
   1. Dow Corning Corp.
   2. Fire Trak Corp.
   3. Hilti Corp.
   4. International Protective Coating Corp.
   5. 3M fire Protection Products.
   6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Multiple component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

2.7 FIRESTOPPING ACCESSORIES

A. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

B. General:
   1. Furnish UL Listed products.
   2. Select products with rating not less than rating of wall or floor being penetrated.

C. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
   2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors or preset inserts as required.
   2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset

fasteners or welded fasteners as required.
3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors as required.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts or hollow wall fasteners as required.
5. Solid Masonry Walls: Provide expansion anchors or preset inserts as required.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Inserts:
1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over four (4) inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

C. Install conduit and raceway support and spacing in accordance with CEC.

D. Do not fasten supports to suspended ceiling support system, pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards one (1) inch off wall.
4. Support vertical conduit at every floor.

3.3 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Remove dam material after firestopping material has cured.

G. Fire Rated Surface:
1. Seal opening at all rated floors and walls as follows:
   a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
   b. Size sleeve allowing minimum of one (1) inch void between sleeve and building

element.
c. Pack void with backing material.
d. Seal ends of sleeve with UL Listed fire resistive silicone compound to meet fire rating of structure penetrated.
2. Where cable tray, bus, or conduit, penetrates fire rated surface, install firestopping product ins accordance with manufacturer's instructions.

H. Non-Rated Surfaces:
1. Seal opening through non-fire rated floors and walls as follows:
a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
c. Install type of firestopping material recommended by manufacturer.
2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

3.4 INSTALLATION - SLEEVES

A. Exterior watertight entries: Provide mechanical sleeve seals.

B. Interior conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors and walls one (1) inch above finished floor level. Caulk sleeves.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Floor boxes.
6. Cabinets, termination cabinets.
7. Gutters.

1.3 SUBMITTALS

A. Provide 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.
6. Cabinets, termination cabinets.
7. Gutters.
8. Putty pads.
9. Raceways

B. Submit detailed conduit routing plan, for review and approval, prior to installation as follows:
1. Exposed and/ or concealed in building walls for conduits larger than 2-inch outside diameter.
2. All underground conduits (3/4-inch and larger) in duct bank; concealed in floor slabs, equipment pads and concrete slabs.

1.4 SUBMITTALS

A. Minimum acceptable conduit sizes are summarized in the following table:

	Minimum Size
Underground, site wiring	1-1/2”
Underground • Building Wiring	1”
Aboveground • Equipment or panel feeders • Telecommunications	3/4"
Aboveground • Lighting or branch circuit wiring • Fire alarm • Security	3/4”

Other	3/4”

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Conform to requirements of the CEC, latest adopted version.
   2. Furnish products listed by UL or other independent and nationally recognized testing firm.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC and PVC-coated metallic conduit from sunlight.

C. 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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Polyvinyl Chloride (PVC) coated galvanized rigid steel conduit and intermediate metal conduit shall be in accordance with NEMA RN 1. Coating shall be applied under controlled factory conditions. Prior to coating, conduit shall meet requirements of ANSI C80.1 and UL 6 or ANSI C80.6 and UL 1242 as appropriate. PVC coated conduits shall have ultra-violet (UV) inhibitor in the coating material.

B. Intermediate Metal Conduit (IMC). Raceway shall be hot dipped galvanized mild steel in accordance with ANSI C80.6 and UL 1242 and shall bear the UL label. Conduit shall have same characteristics of rigid steel except for thinner wall.

C. Galvanized Rigid Steel Conduit (GRSC or RGS), couplings and elbows shall be hot dip galvanized, rigid mild steel in accordance with ANSI C80.1 and UL 6. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate. Conduit shall be formed with continuous welded seams with a uniform wall thickness, in minimum 10-foot lengths, with threaded ends.

D. Electrical Metallic Tubing (EMT). Electrical metallic tubing, including elbows and bends, shall be zinc coated, mild steel in accordance with the requirements of ANSI C80.3 and UL 797. The interior and exterior surfaces of the tubing shall have a continuous zinc coating. Conduit shall be formed with a continuous welded seam, with a uniform wall thickness, in minimum 10-foot lengths.

E. Non-Metallic Conduit shall be as follows:
   1. Schedule 40: Conduit shall be 90 degree Celsius, polyvinyl chloride in conformance with NEMA TC-2 and UL 651 requirements.
   2. Spacers used in duct bank installations shall be high impact plastic, interlocking bases, and intermediate type spacers. Place spacers between 6 and 10 feet apart.

F. Flexible Metal Conduit shall be galvanized steel meeting the requirements of UL 1. Flexible

aluminum conduit is not permitted.

G. Liquid-Tight Flexible Metal Conduit shall be plastic jacketed, galvanized steel, "Sealtite" Type EF for general service areas or Type HC for high temperature when used under raised floor or in air plenums. Conduit shall be UL listed.

H. Manufacturers:
1. Outlet Boxes: Bowers, Raco, Orbit, 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, Raco, Crouse Hinds, or equal.
7. Putty pads: 3M, Hilti, or equal.
8. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
9. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
10. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
11. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liquatite or equal.
12. Floor Boxes, Single Gang, Walker/ Wiremold 880 CS Series or approved equal.
13. Floor Boxes, Multiple Gang, Walker/ Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/ or water resistant device covers.
14. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.

I. Listed products for termination, coupling, extending, benching supports of raceways shall be used.

2.2 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 or equal.

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. 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.

F. 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.

2.3 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.

2.4 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.

2.5 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.

2.6 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.

2.7 PUTTY PADS

A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.

B. 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

2.8 PULLBOXES AND HANDHOLES

A. Construction: High densities precast reinforced concrete box, extension, base, and cover. Furnish box with end and side knockouts and non-settling shoulders. Cover shall have hold-down bolts and two lifting eyes.

B. Size: As indicated on the Drawings.

C. Cover markings: Covers shall read "ELECTRICAL", “COMMUNICATIONS”, or "SIGNAL" as appropriate.

D. Rated covers: Use cast iron lid with H20 traffic rating when subject to vehicular traffic.

PART 3 EXECUTION

3.1 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 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 prior approval from Electrical Engineer. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roof mount conduits, where allowed, with minimum 12” wide approved rooftop supports (B-Line Durablok or approved equal) unless otherwise detailed in roof requirements or as specified in roofing specification. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8’ above finished grade shall be strapped at a minimum of 5’ spacing.

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. 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 tape wrapped.

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 severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.

E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path 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 systemin 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 as follows:
1. PVC elbows 2" and smaller are allowed, or if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
2. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
3. GRS elbows/risers to be PVC coated or 10 MIL tape 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. Pipe nailers (J-hooks) may only be used for 1" conduit and smaller and only in wood frame construction. 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. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).

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. Polywater or equal.
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 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.

M. 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.

N. 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.

O. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

P. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

Q. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.

R. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.

S. Mount outlet boxes, unless otherwise required by ADA and CBC, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".

2. Outlet above counter (measured to top of outlet box): +46".
3. Control (light) Switches. (measured to top of outlet box): +48".
4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

T. 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.

U. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.

V. 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 26 05 33

SECTION 26 05 53 - IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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, motor control, panels, pullboxes, cabinets, motors, generators, transfer switches.
         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.
   2. Conductor and Cable Identification.

B. Related Sections:
   1. Section 26 05 00: Common Work Results for Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
   3. Section 26 20 00 Electrical Distribution Equipment.

C. Reference Standards:
   1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
   2. National Fire Protection Agency (NFPA):
      a. 70E Standard for Electrical Safety in the Workplace.
   3. American National Standards Institute (ANSI):
      a. A13.1 Pipe Markers.
      b. Z535 Standards for Safety Signs and Labels.
   4. Underwriters Laboratories, Inc. (UL):
      a. 969 Standard for Marking and Labeling Systems.
   5. Code of Federal Regulations, Title 29, Part 1910:
      a. 144 Safety color code for marking physical hazards.
      b. 145 Specifications for accident prevention signs and tags.

PART 2 PRODUCTS

2.1 EQUIPMENT LABEL DESIGNATIONS

A. Equipment labels indicating equipment designations both emergency and normal.

Designation per drawings or to be supplied with shop drawings approval.

B. Panelboard labels showing panel designation, voltage, phase, and source.

C. Distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.2 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.

E. Conductor tape number markers: TayMac MX4280 Series non-fading permanent adhesive.

PART 3 EXECUTION

3.1 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.

B. Conductor tape markers shall be consistently placed for ready conductor identification.

3.2 HEIGHTS ON LABELS

A. Panelboards, Switchboards and Motor Control Centers 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.

3.3 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 26 05 53

SECTION 26 20 00 - ELECTRICAL DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract Documents and Division 01 - General Requirements as applicable, apply to this Section.

1.2 SUMMARY

A. Provide all electrical distribution and motor control equipment and accessories required to distribute electrical power to all motors, outlets and systems requiring power.

1.3 QUALITY ASSURANCE

A. New: Provide all new equipment.

B. Single Manufacturer: All equipment of each type shall be the product of one manufacturer.

C. UL: Equipment shall be UL listed. Service entrance equipment shall bear UL Service Entrance label.

D. CEC: Equipment and installation shall comply with the California Electrical Code.

E. Wet Locations: Equipment and enclosures installed outdoors and in wet locations shall be approved for this purpose.

F. IEEE: Institute of Electrical and Electronics Engineers Standard 1015-1997 (Blue Book) Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

1.4 LABELING

A. Nameplates and labeling shall be provided in accordance with Section 26 05 53. All feeders shall be labeled on the feeder device.

1.5 FINISHES

A. All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to a new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Engineer.

1.6 SUBMITTALS

A. Provide complete product data for each equipment type. Provide electric service studies when required.

B. Submittal shall include written recommendation from manufacturer of settings for all electronic trip adjustment setting on all equipment furnished with adjustable trip settings. Contractor is responsible for adjusting all electronic trip settings per manufacturer recommendations.

C. Electrical connections to all equipment furnished by any other division shall be coordinated with final approved equipment submittals from other divisions including but not limited to circuit breaker sizes, conduit sizes, wire sizes, fuse sizes, disconnect switch sizes and starter sizes that differ from those shown on the drawings prior to submitting Electrical Distribution Equipment submittal.

1.7 SHORT CIRCUIT CURRENT RATINGS

A. General: All switchboards and panelboards shall be fully rated and marked with a maximum short circuit current rating. The equipment manufacturer shall have verified this rating with high-amperage testing. All short circuit current ratings are expressed as amperes RMS symmetrical at the applied voltage unless otherwise noted. All equipment shall withstand the specified level of fault current. All overcurrent devices shall interrupt the specified level of fault current.

1.8 ELECTRIC SERVICE STUDIES

A. Standard: Submit studies in accordance with ANSI/ IEEE Standard 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

B. Submit one-line diagram for each electrical service. Key all equipment and components on diagram to items in the studies.

C. Provide a short-circuit current analysis for each main switchboard. Short-circuit analysis shall calculate short-circuit levels at service transformer secondary, switchboard main breaker, each feeder breaker and all levels of downstream distribution equipment. Assume infinite source bus.

D. Provide a time-current coordination study for each main switchboard. Coordination study shall compare the operating levels and times of the protective devices to the withstand levels and times that the equipment can sustain without damage or failure. Determine electronic trip unit settings necessary to achieve optimal selective coordination between 480 volt main service circuit breakers and first level of feeder distribution devices. Determine setting for all adjustments of trip units of all electronic circuit breakers that are linked by zone-selective-interlocking. Furnish time-current curves for the two (or more) levels of distribution protected with electronic trips, plus the first additional distribution level served from the switchboard feeder. Show a separate composite plot for each feeder breaker trip rating with the main breaker. Plot composite time-current curves on log-log background. Add a typical frame size of downstream molded-case circuit breaker to each switchboard feeder composite plot.

E. Provide arc-flash calculation and labeling for equipment in the project.

F. The contractor shall make all adjustments to circuit breakers per electric service study and provide written documentation that all adjustments have been made.

1.9 OWNER'S INSTRUCTION

A. Provide a four-hour period of instruction to the Owner's designated personnel upon completion of the main switchboard’s installation. Review manufacturer’s recommended switchboard maintenance. The Operations and Maintenance Manual shall be complete and on-site at the time of Owner instruction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Unless indicated otherwise, all equipment in this section shall be provided by a single manufacturer. The product designations listed are to establish a level of quality. Acceptable manufacturers are:
   1. Square D.
   2. Siemens.
   3. G.E.
   4. Cutler-Hammer.

2.2 ENCLOSED SWITCHES

A. General: Provide heavy duty enclosed switches similar to Square D Class 3100 Type HD.

B. Switch Interior:
   1. All switches shall have switchblades which are visible when the switch is OFF and the cover is open.
   2. Lugs shall be front removable and UL Listed for 75 degrees Celsius conductors.
   3. All current carrying parts shall be plated to resist corrosion.
   4. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.
   5. Switches shall have provisions for a field installable electrical interlock.

C. Switch Mechanism:
   1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
   2. The operating handle shall be an integral part of the box, not the cover.
   3. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.
   4. The handle position shall travel at least 90 degrees between OFF and ON positions to clearly distinguish and indicate handle position.
   5. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override, but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

D. Switch Enclosures:
   1. Switch covers shall be attached with welded pin-type hinges.
   2. The enclosure shall be finished with gray baked enamel paint, which is electrodeposited on cleaned, phosphate pre-treated steel.
   3. The enclosure shall have ON and OFF markings stamped onto the cover.
   4. The operating handle shall be provided with a dual colored, red/ black position indication,
   5. All switches shall have provisions to accept up to three (3) 3/8-inch hasp padlocks to lock the operating handle in the OFF position.
   6. Tangential knockouts shall be provided to facilitate ease of conduit entry.

E. Switch Ratings:
   1. Switches shall be horsepower rated for ac and/ or dc as indicated on the plans.
   2. The UL Listed short circuit current rating of the switches shall be 200,000 rms symmetrical amperes when used with or protected by Class J fuses.
   3. Non-Fusible: 10,000 rms symmetrical amps.

F. Fuse Clips: NEMA FU 1, Class J fuses.

2.3 SINGLE CIRCUIT BREAKERS WITH ENCLOSURES

A. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.

B. Circuit Breakers: Molded case, quick make, quick break, trip free, common thermal magnetic trip.

C. Ratings: Continuous current, poles as required, 480 volt system breaker shall interrupt short circuits up to 14,000 rms amps symmetrical; on 120/ 208 - 240 volt system, 10,000 amp rms symmetrical.

D. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

E. Nameplate: Provide a nameplate showing load served.

2.4 FRACTIONAL HORSEPOWER MANUAL MOTOR CONTROLLER

A. Square D - Class 2510 Type F:
   1. Description: NEMA ICS 2, ac general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light and toggle operator.
   2. Enclosures: ANSI/ NEMA ICS 6, Type as indicated.

2.5 MAGNETIC MOTOR CONTROLLERS

A. Square D - Class 8536 Type S:
   1. Description: NEMA ICS 2, ac general-purpose Class A magnetic controller for induction motors rated in horsepower.
   2. Coil Operating Voltage: Provide as required to interface with controls system, including control power transformer.
   3. Coil: Be of encapsulated type.
   4. Poles: as indicated.
   5. Size: as indicated.
   6. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
   7. Wiring: Straight-through wiring with all terminals clearly marked.
   8. Overload Relay: NEMA ICS:
      a. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered. Provide phase loss, phase unbalance protection, permanent tamper guard, Trip Class 10 or 20 and a mechanical test function.
      b. Outputs: Units shall be designed for addition of either a normally open or normally closed auxiliary contact and shall be field convertible. Provide one (1) set of N.O. and N.C. contacts in each starter.
      c. Reset: Unit shall include both manual reset and remote reset using an external module.
      d. Select overload current setting based on the motor nameplate data of the actual motor to be protected. All standard NEMA sizes may be used for the overload relay, including Size 00.
   9. Enclosure: ANSI/ NEMA ICS 6, Type 1, 3R or 4X.

10. Control Power Transformers: 120 volt secondary. VA minimum, in each motor starter. Provide fused primary and secondary.
11. Provide red LED running pilot light and H-O-A switch.

2.6 MAGNETIC MOTOR CONTROLLERS - TWO - SPEED

A. Square D - Class 8810 Type S:
   1. Description: Include integral time delay transition between FAST and SLOW speeds. Starters shall be electrically and mechanically interlocked to prohibit both starters being energized simultaneously.
   2. Coil operating voltage: Provide as required to interface with controls system, including control power transformer.
   3. Coil: Be of encapsulated type.
   4. Poles: as indicated.
   5. Size: as indicated.
   6. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts.
   7. Contact inspection and replacement shall be possible without disturbing line or load wiring.
   8. Wiring: Straight-through wiring with all terminals clearly marked.
   9. Overload Relay: NEMA ICS.
      a. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered. Provide phase loss, phase unbalance protection, permanent tamper guard, Trip Class 10 or 20 and a mechanical test function.
      b. Outputs: Units shall be designed for addition of either a normally open or normally closed auxiliary contact and shall be field convertible. Provide one (1) set of N.O. and N.C. contacts in each starter.
      c. Reset: Unit shall include both manual reset and remote reset using an external module.
      d. Select overload current setting based on the motor nameplate data of the actual motor to be protected. All standard NEMA sizes may be used for the overload relay, including Size 00.
   10. Enclosure: ANSI/ NEMA ICS 6, Type 1, 3R or 4X.
   11. Two speed motor controllers shall be designed for type of motor winding specified in Division 23 Mechanical Specifications, Drawings, or Equipment Schedule. Coordinate with Division 23 prior to submittal.
   12. Provide red-high, amber-low running pilot lights and H-O-L-A switch.
   13. Provide two speed motor controllers for all two speed motors specified in Division 23 Mechanical Specifications, Drawings, or Equipment Schedule. Coordinate with Division 23 prior to submittal.

2.7 COMBINATION DISCONNECT/ MOTOR STARTERS

A. Square D - Class 8538 Type S (Fusible or no fuse, as shown on plans):
   1. Description: Combine magnetic motor controllers with fusible switch disconnect in common enclosure. The switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON/ OFF with red and black color-coding.
   2. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class J fuses and visible blades. Operating handle shall give positive visual indication of ON/ OFF with color-coded operating handle.
   3. Magnetic Motor Controllers: Refer to paragraph(s) specifying magnetic motor controllers for requirements.

2.8 FUSES (600 VOLTS AND BELOW)

A. Manufacturers:
   1. Bussmann.
   2. Little Fuse.
   3. Ferraz Shawmut.

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

D. Class J (Time Delay) Fuses:
   1. Dimensions and Performance: NEMA FU 1.
   2. Voltage: Rating suitable for circuit phase-to-phase voltage.
   3. Dual-element, time delay ten (10) seconds (minimum) at 500 percent rated current.

E. Spares: Spare fuses shall be provided in the amount of ten (10) percent of each type and size installed. Replacement for fuses and limiters blown during construction shall not count as spares.

2.9 DISTRIBUTION PANELBOARDS

A. Product Description: NEMA PB 1, circuit breaker type panelboard.

B. Panelboard Bus: copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

C. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

D. Main Circuit Breaker:
   1. When distribution panel has main circuit breaker, provide molded case circuit breaker with electronic trip unit. Current sensing to be true-rms.
   2. Main breaker shall have minimum interrupting rating of 65,000 amperes rms symmetrical at applied voltage.
   3. Electronic trip shall be Square D micrologic with adjustable long-time, short-time and instantaneous pick-up set points.

E. Cabinet Front: Safety dead front type. Conform to NEMA 1; NEMA 3R if located outdoors. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.

2.10 BRANCH CIRCUIT PANELBOARDS

A. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

B. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

C. For non-linear load applications subject to harmonics furnish 173 percent rated, plated copper, solid neutral.

D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208-240/ 120 volt panelboards; 22,000 amperes rms symmetrical for 480 volt panelboards.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.

F. Enclosure: NEMA PB 1, Type 1 or Type 3R. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.

G. Cabinet Front: Safety dead front type with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

H. Provide ground-fault circuit breaker for each heat trace branch circuit.

I. Panelboards indicated to have thru-feed lugs shall be furnished with thru-feed lugs in all sections of panelboard.

2.11 ROOF MOUNTED PEDESTALS

A. Roof Utility Pedestal with 20 Amp GFCI/ Weatherproof receptacle - Provide MAPA Products utility roof pedestal #MPX-20G: 36/ 12.

B. Roof Pedestal with Non-Fused Disconnect Switch and 20 Amp GFCI/ Weatherproof receptacle - Provide MAPA Products roof pedestal. See plans for disconnect sizes.

PART 3 - EXECUTION

3.1 MOUNTING

A. General: All equipment shall be securely fastened in place.

B. Locations: In all cases mounting locations shall comply with the requirements of the California Electrical Code. This shall include providing suitable working clearances.

C. Concrete Pads:
1. Provide concrete in accordance with the Division of the Specifications for that product.
2. Indoor concrete pads shall consist of a four (4) inch pad with beveled edges extending two (2) inches beyond the perimeter of supported equipment. Switchboards, motor control centers, transformers greater than 15 KVA, and engine generators shall be installed on a pad. Refer to the drawings and the specifications for each piece of equipment to determine what other equipment shall be mounted on a pad.
3. All equipment, ground mounted outdoors, shall be mounted on a pad. Outdoor pads shall be minimum of one foot thick reinforced with #4 rebar one (1) foot on center each way. Size outdoor pads with at least four (4) feet working clearance in front of equipment and one (1) foot on all sides. Provide anchor bolts for pad-mounted equipment. Refer to Detail on drawings.

A. Wall Mounted Equipment: Wall mounted equipment shall be suitably positioned on the wall. Equipment mounted on the exterior basement wall shall have unistrut channels between the wall and the equipment to prevent condensation problems. Where wall mounted equipment is specified, but a convenient wall not available, a suitable unistrut mounting stanchion anchored in concrete shall be provided. In lieu of this stanchion, small devices may be mounted on to the equipment served if approved by the equipment manufacturer.

B. Motor rated disconnects: Install disconnects in a vertical orientation with off in the down position.

3.2 DELIVERY, STORAGE AND HANDLING

A. General:
1. Store all types of electrical power distribution equipment in a clean, heated building affording appropriate physical protection. Control access to prevent unauthorized tampering with the equipment. However, equipment may be stored in other inside or outside environments under approved conditions.
2. Inspect equipment when received at Project site for shipping damage. Report as required by freight carrier to recover repair or replacement costs from the freight carrier in the event damage was sustained.
3. Covers are required unless indoor, ventilated storage conditions exist. Canvas tarpaulins or the equivalent are preferred over other coverings because they provide better humidity control and enclosure scuff protection. Where exposed to moisture, covers shall be waterproof.
4. The manufacturer's shipping skids shall be left on the equipment to provide structural support until the equipment is set in the final resting place.
5. Refer to Section 26 05 00 for additional requirements. Contractor shall furnish new equipment to replace any equipment that is exposed to weather or subjected to other deleterious effects of construction.

B. Approved Conditions for Equipment Storage:
1. General: Where storage conditions specified above are not available, indoor or outdoor storage shall comply with the following.
2. Switchboards, Motor Control and Other General Distribution and Utilization Equipment:
   a. Store metal-enclosed equipment in an upright position. Provide good ventilation of the shelter and protection from dirt, moisture and physical damage.
   b. Space heaters furnished with the equipment shall be connected to a continuous source of power of the proper rating. Where space heaters are supplied from auxiliary power transformers, care shall be taken that low-voltage heater circuits are properly isolated before power source connection to prevent inadvertent energizing of the auxiliary transformer and associated high-voltage primary wiring.
   c. Ambient conditions may allow condensation inside waterproof covers. If condensation is occurring, temporary heaters or lamp banks shall be provided of sufficient wattage to prevent condensation.
   d. Contractor shall ensure that equipment stored in shipping cases receives adequate ventilation to avoid mildew and prevent condensation.

C. Transformer
1. Indoor storage shall be provided for all transformers.

3.3 GROUND FAULT PROTECTION OF EQUIPMENT

A. General: Provide for system performance testing as required by the California Electrical Code. Provide each ground fault relay, sensing device or ground fault protection system with instructions and a test form. The form shall be retained by those in charge of the building's electrical installation and be available to the authority having jurisdiction. The instruction content shall be as required by UL.

3.4 LABELING

A. Nametag: Provide a nametag for each piece of distribution equipment; see Section 26 05 53, Electrical Identification.

END OF SECTION 26 20 00

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
   1. Wiring devices.

B. Related Sections:
   1. Section 26 05 00: Common Work Results for Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
   3. Section 26 05 26: Grounding and Bonding for Electrical Systems.
   4. Section 26 05 33: Raceway and Boxes for Electrical Systems.

C. Reference Standards:
   1. California Electrical Code (CEC). California Code of Regulations, Title 24, Part 3.
   2. National Electrical Manufacturers Association (NEMA):
      a. WD 1 General Color Requirements for Wiring Devices.
      b. WD 6 Wiring Devices - Dimensional Specifications.
   3. National Electrical Manufacturers Association (NECA):
      a. 1 Good Workmanship in Electrical Construction.
   4. National Electrical Testing Association (NETA):
      a. ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   5. Underwriters Laboratories, Inc. (UL):
      a. 20 Safety General-Use Snap Switches.
      b. 231 Standard for Power Outlets.
      c. 498 Attachment Plugs and Receptacles.
      d. 943 Ground-Fault Circuit-Interrupters.
      e. 1436 Standard for Outlet Circuit Testers and Similar Indicating Devices.
      f. 1472 Solid-State Dimming Controls.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Receptacles, Switches, Wall Plates:
   1. Cooper Wiring Devices; Division of Cooper Industries, Inc.
   2. Hubbell Incorporated; Wiring Device-Kellems.
   3. Leviton Mfg. Company, Inc.
   4. Pass & Seymour/ Legrand.

2.2 RECEPTACLES

A. General for all receptacles:
   1. Device shall be listed by UL
   2. 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.

3. Receptacles shall be of a screw terminal type, “pressure type quick wire” terminations are not allowed.

B. 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:

1. Wiring device color shall be standard white. Contractor to verify device color with Architect prior to procurement.
2. 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.

C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.

D. Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap.

2.3 SWITCHES

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 plasters ears and be of a screw terminal type.
2. Shall be color coded for current rating, listed by UL, 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.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel.

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

3.1 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, ADA, and CBC with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.

F. Install switches with the off position down.

G. Clean debris from outlet boxes.

H. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.

I. Test each receptacle device for proper polarity.

END OF SECTION 26 27 26

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
   1. Interior lighting systems, including luminaires, LED's, and emergency lighting equipment.

B. Related Sections:
   1. Section 26 05 00: Common Work Results for Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
   3. Section 26 05 26: Grounding and Bonding for Electrical Systems.
   4. Section 26 05 33: Raceway and Boxes for Electrical Systems.

C. Reference Standards:
   1. California Electrical Code (CEC) based on NFPA 70 (NEC). California Code of Regulations, Title 24, Part 3.
   2. California Energy Code. California Code of Regulations, Title 24, Part 6.
   3. National Electrical Manufacturers Association (NEMA).
      a. 50 Enclosures for Electrical Equipment.
      b. 67 Panelboards.
      c. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures.
   4. Underwriters Laboratories, Inc. (UL).
      a. 50 Enclosures for Electrical Equipment.
      b. 67 Panelboards.
      c. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures.
   5. Aluminum Association Inc. (AA).
   6. Illuminating Engineering Society of North America (IESNA or IES).

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00: 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.

1.4 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

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with CEC, 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. Fixtures with louvers or light transmitting panels shall have hinges, latches, and safety catches to facilitate safe, convenient cleaning and relamping.

F. 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.

G. 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

reflectance's, except where otherwise specified on the drawing.
3. Exterior finishes shall be as shown on the drawings.

H. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

I. 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.

J. Recessed compact LED fixtures shall be manufactured specifically for LED lamps with drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion.

2.3 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.

2.4 EMERGENCY FIXTURE POWER SUPPLY

A. Self-contained battery-operated power supply for operating specified fixture for a minimum output of 90 minutes.

B. The power supply shall be installed within the luminaire ballast compartment or wireway. Provide with test switch and charge indicator installed integral to the luminaire. The test switch and charge indictor may be installed in a remote ceiling mounted flush J-box for recessed downlights which cannot accept integral components.

C. Performance: Emergency operation lumen output for specified fixtures shall be a minimum of 600 lumens.

2.5 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.

2.6 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 Measured CCT (K)
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

3.1 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 re-lamping.
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. "Drop-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. "Tek 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 blocking 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 1/4-20 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. 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.

G. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26: Grounding and Bonding for Electrical Systems.

H. Provide unswitched leg of interior lighting branch circuit to integral emergency battery pack light fixtures, exit signs and night lights as applicable per lighting plans.

I. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION 26 51 00

SECTION 28 05 00 - GENERAL ELECTRONIC SAFETY SYSTEMS REQUIREMENTS

PART 1 – GENERAL

1.1 WORK INCLUDES

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

B. Furnishing of all required materials, equipment, tools, scaffolding, labor, and transportation necessary for the complete installation of the Electronic Safety Systems as shown on the drawings and as specified herein.

C. Coordinate wireway, raceway, power, and outlet requirements with the builder and the electrical contractor.

D. Cable pathways, conduit, boxes and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

E. The Electronic Safety Systems Contractor shall provide and install prior to cable installation plastic snap in bushings at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves to protect the cabling from damage.

F. Supply in a timely manner to the electrical contractor special backboxes for installation as required.

G. It is the intent of the Contract Documents to provide complete installations although every item necessary may not be specifically mentioned or shown.

H. It is the intent of the Contract Documents to provide an extension of the existing installed systems interfaced with new systems, complete in every respect.

I. Provide line-by-line specification review for each Division 28 section annotated to certify compliance or deviation.

1.2 WORK TO BE INCLUDED BY THE ELECTRICAL CONTRACTOR IN BASE CONTRACT PROPOSAL

A. Provide utility services conduit as outlined on drawings as required.

B. All required conduit for accessibility to attic space.

C. Furnishing and installation of all required standard back boxes and conduit.

D. Installation of special back boxes supplied by Division 28 contractor(s).

E. Furnishing and installation of all floor boxes, surface raceways, and other wireways which are detailed or specified under Division 26.

F. Provide equipment-mounting boards as outlined on drawings.

G. Provide equipment grounding system, conductors, and bus bars and as outlined in Division 26.

H. Provide 120-volt power and hook-up to equipment provided in Division 28.

I. Coordination of requirements of Division 28 with the Builder.

1.3 WORK NOT INCLUDED

A. Contractors shall make no agreement that obligates the Owner to pay any company providing communications, monitoring, or other services. Contractors shall not make selection, purchase, or installation of interconnect instruments/equipment to be used on this project.

1.4 RELATED SECTIONS

A. The conditions of the Division 0, Division 1, Division 26 requirements, and the contract requirements that include the General Conditions and the Supplementary Conditions apply to work of this division.

B. Section 26 05 34 - Provisions For Communication, Security & Safety Systems.

1.5 CODES, STANDARDS, AND THEIR ABBREVIATIONS

A. General:
   1. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.
   2. In addition to the requirements outlined in other sections of the specifications the following standards are imposed as applicable to the work in each instance:
      a. OSHA Safety and Health Regulations for Construction.
      b. NFPA No. 70 National Electrical Code.
      c. NESC National Electrical Safety Code, ANSI Standard C2.
      d. NEiS National Electrical Installation Standards.
      e. Local Codes and Ordinances.

B. Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof. Any such additional work shall be performed at no additional cost to the Owner.

C. Materials and components shall be UL listed and labeled by Underwriters Laboratories, Inc. for the intended use under the latest appropriate testing standard.

D. The Contractor shall obtain all permits required to commence work. Upon completion of the Work, the Contractor shall obtain and deliver to the Owner's Representative a Certificate of Inspection and Approval from the State Board of Fire Underwriters, the City of Little Elm, Texas, and other authorities having jurisdiction. The Contractor shall pay required permit fees.

1.6 LIST OF ASSOCIATIONS AND STANDARDS:

ADA:	Americans with Disabilities Act.
ANSI:	American National Standards Institute, 1430 Broadway; New York, NY 10018.
ASTM:	American Society for Testing and Materials, 1916 Race Street; Philadelphia, PA 19103.
BICSI:	(RCDD5 Standards), 8610 Hidden River Parkway, Tampa, FL 33637
CBM:	Certified Ballast Manufacturers Association, 2116 Keith Building; Cleveland, Ohio 44115.
IEEE:	Institute of Electrical and Electronics Engineers, 345 East 47th Street; New York, NY 10017.
ICEA:	Insulated Cable Engineers Association, P.O. Box P, South Yarmouth, MA

02664.
NEC: National Electrical Code; NFPA No. 70.
NECA: National Electrical Contractors Association, Inc., 7315 Wisconsin Ave.; Washington, DC 20014.
NEMA: National Electrical Manufacturers Association, 155 East 44th Street; New York, NY 10017.
NESC: National Electrical Safety Code, ANSI Standard C2.
NFPA: National Fire Protection Association, 60 Batterymarch Street; Boston, MA 02110.
OSHA: Occupational Safety and Health Administration, US Department of Labor; Washington, DC 20402.
TAS: Texas Accessibility Standards (TAS) Article 9102.
UL: Underwriters Laboratories, Inc., 333 Pfigsten Road; Northbrook, IL 60062.

A. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.

B. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.

C. The date of the code or standard is that in effect on the date of issue stated on the contract documents, except when a particular publication date is specified.

D. The Contractor shall comply with all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

E. Where local codes and ordinances are not in writing or on record but local precedence have been set, the Owner shall pay for any additional resulting cost.

1.7 DEFINITIONS

A. Approval: It is understood that approval must be obtained from the Architect in writing before proceeding with the proposed work. Approval by the Architect of any changes, submitted by the Contractor, will be considered as general only to aid the Contractor in expediting his work.

B. The Builder: The primary contractor engaged to oversee the construction project. They may be technically described as a Construction Manager, General Contractor, Managing Construction Contractor, et cetera.

C. The Contractor: The Contractor engaged to execute the work included a particular section only, although he may be technically described as a Subcontractor to the Builder. If the Contractor, engaged to execute said work, employs Sub-Contractors to perform various portions of the work included under a particular Section, they shall be held responsible for the execution of this work, in full conformity with Contract Document requirements. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various sections and phases of work may be properly coordinated without unnecessary delays or damage.

D. The Electrical Contractor: The Electrical Contractor shall be engaged to execute the work included Division 26 only.

E. PDF file or .pdf: The filename extension associated with “Portable Document Format” files, which are multi-platform computer files in the ISO 32000-1:2008 open standard format developed and licensed by Adobe Systems. These files are a digital electronic representation of text, documents, images, and technical drawings in a font and color-accurate fixed-layout format that is platform and display resolution independent. PDF files can be electronically

transmitted, viewed, or printed with various free PDF reader application programs, and may allow markups/comments with various PDF editing application programs.

F. Provide: Defined as requiring both the furnishing and installation of the item or facility indicated, complete in all respects and ready for operation unless otherwise specifically noted.

1.8 SCHEDULE OF VALUES, APPLICATION FOR PAYMENT

A. The Contractor shall in accordance with the General Provisions of the Contract, including General and Supplementary Conditions, and Division 1, complete a Schedule of Values and Applications for Payment. When a portion of this work separately funded, including donations or E-Rate, the contractor shall accommodate this in the Schedule of Values and Applications for Payment. For E-Rate eligible portions of this work, the contractor will be required to participate in the E-Rate program, comply with all E-Rate regulations, and provide billing as needed. The contractor shall coordinate with the Owner to file Form 471 or latter edition and/or other forms as may be required.

1.9 WARRANTY

A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from date of acceptance of the job.

B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.

C. He shall remedy any defects due thereto, and pay for any damage to other work resulting there from, which shall appear within a period of one year from date of substantial completion.

D. The Owner shall give notice of observed defects with reasonable promptness.

E. This Warranty shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.10 SITE VISIT

A. Before submitting a proposal, each proposed contractor shall examine all plans and specifications relating to the work, shall visit the site of the project, and become fully informed of the extent and character of the work required, including all required utilities.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.11 SUBMITTALS

A. Submittal procedures shall be per Division 1 - General Requirements.

B. Provide a complete submittal for each section as specified.

C. Submit complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

D. A submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized

including index tabs in a 3-ring black binder of sufficient size.

E. Each Product data submittal shall include:
   1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
   2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
   3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
   4. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
   5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
   6. When the contract requires extended product warranties, submit a sample of warranty language.
   7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

F. Submit shop or coordination drawings, when specified or the required for the scope of work, which include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

G. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

1.12 PROJECT RECORD DOCUMENTS

A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.

B. Upon submitting his request for final payment, he shall turn over to the Architect/Engineer, for subsequent transmittal to the Owner revised plans showing "as installed" work.

C. In addition to the above, the Contractor shall accumulate during the jobs progress the following data in PDF file format (preferred) or paper copies to be turned over to the Architect/Engineer for checking and subsequent delivery to the Owner:
   1. All warranties, guarantees, and manufacturer's directions on equipment and material covered by the Contract.
   2. PDF file or paper copies of all Shop Drawing prints and CAD or BIM engineering drawing program files.
   3. Any software programs, data/programming files, passwords, special interface cables, or keys that may be needed to maintain or access equipment.
   4. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
   5. Any and all other data and/or plans required during construction.
   6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.

7. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
   a. Builder and all Contractors.
   b. Major Equipment Suppliers
   c. Submit communication systems warranties.

1.13 TRAINING

A. Upon completion of the work and at a time designated by the Architect, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all Electronic Safety Systems equipment and systems.

B. See other sections for time requirements.

1.14 PLANS AND SPECIFICATIONS

A. The intent of the project drawings is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.

B. Electrical drawings are generally diagrammatic and show approximate location and extent of work.

C. Install the work complete including minor details necessary to perform the function indicated. Provide Electronic Safety Systems (including all hook-ups) complete in every respect and ready to operate.

D. If clarification is needed, consult the Architect/Engineer.

E. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer for his interpretation.

F. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

1.15 PRODUCT SUBSTITUTIONS:

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose systems which differ in manufacturer, features, functions, or operating characteristics from those outlined in these specifications must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified and include relevant technical and cost data. This shall include a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

D. The Engineer will consider all such submittals and the Architect will issue an addendum listing items that the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

E. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of the alternate system shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure the system will be an acceptable equivalent.

F. The Contractors' proposal represents that the contract proposal price is based solely upon the materials, equipment, and labor described in the Contract Proposal Documents (including addenda, if any) and that he contemplates no substitutions or extras.

G. The manufacturer of the proposed substitute unit shall provide samples for evaluation, when required, at no charge and non-returnable.

H. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equivalent or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that he would for that specified.
   3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
   4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
      a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
      b. The specified product is unavailable through no fault of the Contractor.
      c. The manufacturer refuses to warranty the specified products as required.
      d. Subsequent information indicates that the specified product is unable to perform properly or to fit in the designated space.
      e. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
      f. Revisions to the electrical system caused by substitutions shall be under the supervision of the Engineer, at a standard hourly rate charged by the Engineer. Charges from the Engineer, Architect, and Electrical Contractor shall be paid by the Contractor originating the changes.

1.16 FUTURE USE CABLING

A. When cabling is installed for future use, it shall be identified with a tag of sufficient durability to withstand the environment involved.

B. Locations and Existing Conditions:
   1. Location and condition of any existing equipment or services, when shown, have been obtained from substantially reliable sources, are shown as a general guide only, without guarantees as to accuracy.
   2. The Contractor will examine the site, verify all requirements, service points, and availability of all services required to complete this project. No consideration will be granted for any alleged misunderstanding of the materials and labor to be provided as necessitated by nature of the site including those items that may be fairly implied as essential to the execution and completion of any and all parts of this project.

1.17 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by the Contractor.

1.18 FINAL OBSERVATION

A. It shall be the duty of the Contractor to make a careful observation trip of the entire project, assuring themselves that the work on the project is ready for final acceptance before calling upon the Architect/Engineer to make a final observation.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, et cetera, called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect/Engineer at or before the time of said final observation. The Contractor is cautioned to check over each bond, receipt, et cetera, before preparing for submission to verify that the terms check with the requirements of the specifications.

C. The following and other provision of Division 1 General Conditions will be required at time of final completion:
   1. Final clean up completed.
   2. All systems are fully operational, all material and devices installed.
   3. As built (as installed) drawings and operations manuals.

1.19 PROHIBITED MATERIALS

A. No new asbestos, lead, or materials containing these substances shall be permitted in this project. The Contractor shall consult the Architect concerning these materials if their presence is suspected. All work in or around existing asbestos or lead materials is at the sole risk of the Contractor and his personnel.

1.20 CUTTING AND PATCHING

A. Notify the Builder sufficiently ahead of construction of any floors, walls, ceiling, roof, et cetera, of any openings that will be required for his work.

B. The Contractor shall see that all sleeves required for his work are set at proper times to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, et cetera, as required for the proper installation of the work under this Contract shall be done at the Subcontractor or at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.

D. Patching of openings and/or alterations shall be provided by the Electronic Safety Systems Subcontractor or at the Subcontractor's expense in an approved manner.

E. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

H. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

1.21 MANUFACTURERS' INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the drawings and specifications, manufacturer's instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions.

C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.

1.22 INSTALLATION

A. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts are considered a part of this work. In order to effect timely and accurate placing of work and to bring together, in the proper and correct sequence, the work of such trades, including work provided under a Division 1 allowance.

B. The Electronic Safety Contractor shall coordinate installation of the systems with the Builder, Electrical, Mechanical, and Plumbing Contractors to ensure a complete working system for the Owner.

C. Where required for accessibility all conduit and boxes for all Electronic Safety Systems shall be provided by the Electrical contractor as specified, including systems in Division 28, any and all allowances shall be included. Normally low voltage wiring shall run open and supported in accessible attic space. All low voltage wiring in exposed areas such as gyms, stages, shops, and field houses shall be enclosed in conduit. Coordinate with, and verify with Division 26 to provide required conduit and boxes at locations and heights as required.

D. Conduit, innerduct, track, or raceway shall conceal and protect wiring in exposed areas, within walls, through in- accessible areas, floors, chases, under slab, crawlspaces, or underground.

E. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

F. All work must be performed by workers skilled in their trade. The installation must be complete whether the work is concealed or exposed.

G. Provide stainless screw/bolt hardware wherever stainless devices are used and in potentially wet areas.

H. Coordinate the actual locations of devices and outlets and equipment with building features and mechanical equipment as indicated on architectural, structural, and mechanical drawings. Review with the Architect any proposed changes in outlet or equipment location. Relocation of devices, before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Architect.

1.23 ADDITIONAL MATERIALS: INCLUDE IN THE BASE CONTRACT PROPOSAL

A. All costs to provide 10 additional fire alarm signals including all cable and devices as directed by the Architect. Conduit and standard back boxes by Division 26 Electrical Contractor.

PART 2 – PRODUCTS

A. Not Applicable

PART 3 – EXECUTION

A. Not Applicable

END OF SECTION

SECTION 28 31 00 - FIRE DETECTION AND NOTIFICATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. This specification document provides the requirements for the installation, programming and configuration of a complete Honeywell Farenhyt Series IFP-2100ECS digital protocol analog addressable fire alarm system with integrated Emergency Communication System capabilities (ECS). This system shall include, but not be limited to, system cabinet, power supply, voice command module, microphone, built in Signaling Line Circuit (SLC), 160 character LCD annunciator, eight programmable Flexputs™, built in dual line, IP and optional cellular digital communicator associated peripheral devices, batteries, wiring, conduit and other relevant components and accessories required to furnish a complete and operational life safety system.

B. The contractor shall furnish and install a complete 24 VDC, electrically supervised, addressable fire alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible and visual notification appliances, alarm devices, and all accessories required to provide a complete operating fire alarm system.

C. All fire alarm system equipment shall be listed for its intended purpose and be compatibility listed to assure the integrity of the complete system.

D. The system shall be wired as a style B and style 4 supervised system for all circuits.

E. Wireless devices shall not be used as components of the fire alarm system unless explicitly directed by the Owner and Architect, with written documentation.

F. The contractor shall include all cable and installation labor for all devices.

1.2 CODES AND STANDARDS

A. The fire alarm equipment and installation shall comply with the current provisions of the following standards and shall be listed for its intended purpose and be compatibility listed to insure integrity of the complete system.

1. California Electric Code

2. National Fire Protection Association Standards:

NFPA 13	Installation of Sprinkler Systems
NFPA 15	Water Spray Fixed Systems
NFPA 16	Deluge Foam Water Systems
NFPA 70	California Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 720	Standard for the Installation of CO Detection

3. Local and State Building Codes
    i. BOCA, California Building Code, Mechanical Code, Fire Prevention Code

4. Local Authorities Having Jurisdiction

5. Underwriters Laboratories Inc.
    i. All equipment shall be approved by Underwriters Laboratories, Inc. for its intended purpose, listed as power limited by Underwriters Laboratories, Inc., for the following standards as applicable:

UL 864 UOJZ	Control units for Fire Protective Signaling Systems Local Signaling Unit Central Station Signaling Protected Premises Unit Remote Signaling Protected Premises Unit. Water Deluge Releasing Unit
UL 2572	Mass Notification Standard
UL 2075	CO Detectors Connected to FACP
UL 268	Smoke Detectors for Fire Protective Signaling systems
UL 268A	Smoke Detectors for duct applications
UL 217	Smoke Detectors for Single Stations
UL 521	Heat Detectors for Fire Protective Signaling systems
UL 228	Door Holders for Fire Protective Signaling systems
UL 464	Audible Signaling appliances
UL 1638	Visual Signaling appliances
UL 38	Manually Activated Signaling Boxes
UL 346	Waterflow indicators for Fire Protective Signaling systems
UL 1481	Power Supplies for Fire Protective Signaling systems.
UL1711	Amplifiers for Fire Protection Signaling Systems

6. Americans with Disabilities Act (ADA).
    i. All visual Notification appliances and manual pull stations shall comply with the requirements of the Americans with Disabilities Act.

1.3 ACCEPTABLE MANUFACTURERS

A. To establish the type, quality, and features of system required, the equipment specified is that of Honeywell Farenhyt Series.

B. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.

C. All references to manufacturer or supplier's model numbers and other pertinent information herein is intended to establish a minimum standard of quality, performance and features required. All equipment proposed as an EQUAL to that specified shall COMPLETELY conform to the specifications herein.

D. Equipment of other manufacturer's or supplier's may be considered as an equal to that specified provided that completely marked and identified catalog sheets of all proposed equipment is provided to the architect/ engineer for review ten (10) days prior to the date of bid for evaluation. In addition, a list of the contractor's qualifications and any exceptions to the specifications must be provided for review. Approval for any such substitution of equipment must be obtained in writing from the architect/engineer five (5) days prior to bid.

E. Provide the following manufacturer:

1. Honeywell Farenhyt Series.
   i. No substitutions.

1.4 GENERAL REQUIREMENTS

A. Contractor Qualifications:

1. The equipment supplier shall be an authorized and designated representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment.
2. The equipment supplier and installing contractor shall be licensed by the State Fire Marshall to sell, install, and service fire alarm systems as required by Article 5.43-2 of the Texas Insurance Code.
3. The installing contractor and/or equipment supplier shall have on his staff a minimum of three (3) installation superintendents who are licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the Texas Insurance Code.
4. The installing contractor or equipment supplier shall have on staff a minimum of one (1) certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place.
5. The installing contractor shall provide 24 hour, 365 days per year emergency service with qualified and state licensed service technicians.
6. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least ten (10) years.

1.5 SUBMITTALS

A. The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:

1. Control panel configuration including wiring and interconnection schematics.
2. Complete point to point wiring diagram showing terminal connections to all system devices.
3. Riser wiring diagram and associated zoning/addressing configurations with associated conduit sizes.
4. Complete floor plan drawings locating all devices associated with the fire alarm system. Floor plan drawings shall include conduit and wiring routing complete with conduit sizing and number of conductors by type.
5. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.
6. Detailed system description in this specification format describing system functions and operation. All specification variations and deviations shall be clearly noted and marked.
7. Complete Bill of Material for reference.
8. Programming matrix defining all input/output functions and zoning.
9. Power supply and battery calculations.
10. A letter from the manufacturer stating that the fire alarm system contractor is authorized to sell, service and install the submitted equipment.

B. All submittal data will be in bound form with contractor's name, supplier's name, project name, and state fire alarm license number adequately identified.

C. Only basic equipment devices have been shown on the contract drawings. Specific wiring between equipment/devices has not been shown. It is the contractor's responsibility to submit for approval the COMPLETE ENGINEERED system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein.

1.6 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all trades including, but, not exclusive of: electrical contractor, sprinkler contractor, and HVAC/controls contractor and intercom system. Adequate coordination shall be provided to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

PART 2 - SPECIFICATIONS

2.1 CONTROL PANEL

A. The fire alarm control panel (FACP) shall be the Honeywell Farenhyt Series IFP-2100ECS analog addressable fire alarm control panel and emergency communication system. The audio amplifiers shall be the Honeywell Farenhyt Series ECS-50W, ECS-125W, ECS-INT50W or ECS-DUAL50W voice evacuation units. The FACP must have a 9 amp power supply and be capable of expansion to a minimum of 384 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.

B. The system must contain at least one (1) Honeywell Farenhyt Series ECS-50W, ECS-125W, ECS-INT50W or ECS-DUAL-50W amplifier and shall be expandable from 50 to 2000 watts utilizing up to 15 additional amplifiers. The ECS-50W and ECS-125W amplifiers shall be capable of adding a 4 zone splitter (ECS-CE4) to distribute the audio information to different locations in the installation. The system shall have the capability of controlling up to 64 notification zones. The amplifiers must contain the capability of being remotely located through a four-wire SBUS communications circuit and a two-wire VBUS voice circuit. The system shall have the capability of adding up to 15 ECS-LOCs local operating consoles.

C. The voice evacuation system must have the capability of downloading fifteen (15) 60 second messages and utilize DSP technology for higher audio intelligibility.

D. The voice evacuation system shall be capable of operating at 25vrms or 70.7vrms (ECS-50W, ECS-INT50W and ECS-DUAL50W only) and must be field selectable at the amplifier level. Systems that require additional modules for voltage conversion shall not be accepted.

E. The FACP must have Day/Night sensitivity capabilities on detectors and be capable of supporting up to 2,100 analog addressable points. This shall be accomplished via signaling line circuits (SLC) capable of supporting a minimum of 159 detectors and 159 module devices each. The main panel will contain one SLC circuit with the option of utilizing 6815 expander modules. The communication protocol on the SLC loop must be digital.

F. The FACP must support a minimum of eight programmable Flexput™ circuits. The panel must have a built in 160 character LCD annunciator with the capability of having an additional supervised remote annunciators connected in the field.

G. The FACP must have a built in UL approved IP and digital communicator with the option of adding a cellular module for communications. The communicator must allow local and remote

up/downloading of system operating options, event history, and detector sensitivity data.

H. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.

I. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have day/night sensitivity adjustments, maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core programming software on site or over the telephone.

J. The main communication bus (SBUS RS485) shall be capable of class A or class B configuration with a total SBUS length of 6,000 feet.

K. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system.

L. The FACP must have the ability to upgrade the firmware revision from a laptop where the FACP is installed.

M. Panels that do not have these capabilities will not be accepted.

2.2 SYSTEM WIRING

A. The Signaling Line Circuit (SLC) and data communication bus (SBUS) shall be wired with standard NEC 760 compliant wiring. No twisted, shielded or mid-capacitance wiring is required for standard installations. All FACP screw terminals shall be capable of accepting 14-18 AWG wire. All system wiring shall be in accordance with the requirements of NFPA 70, the California Electrical Code (NEC) and also comply with article 760 of the NEC.

2.3 SIGNALING LINE CIRCUITS

A. Each SLC shall be capable of a wiring distance of 5,000 feet from the panel or SLC driver module (6815) and be capable of supporting 318 devices. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC within 10 seconds. The auxiliary 6815 SLC loop module must be capable of being located up to 6,000 feet from the FACP on a SBUS, which is separate from the SLC. The SLC shall be capable of functioning in a class A or class B configuration.

2.4 SLC LOOP DEVICES

A. Devices supported must include analog photoelectric, analog heat detectors, addressable input modules, relay output modules, addressable notification modules or wireless gateway. Each SLC loop shall support up to 159 detectors and 159 modules.

2.5 ANALOG DETECTOR FUNCTIONS

A. The products of combustion detectors must communicate analog values using a digital protocol to the control panel for the following functions:

- Automatic compliance with NFPA 72 standards for detector sensitivity testing
- Drift compensation to assure detector is operating correctly
- Maintenance alert when a detector nears the trouble condition
- Trouble alert when a detector is out of tolerance

2.6 SENSITIVITY FUNCTION

A. The FACP shall have the ability to set three different sensitivity levels. A zone can be programmed to a day and a night sensitivity value. The day/night schedule shall allow for 16 holiday dates that are user programmable to allow the FACP to respond at the night level on those days.

2.7 PROGRAMMABLE FLEXPUTS

A. The FACP shall support eight programmable Flexput™ circuits that are capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable or door holder power. The circuits shall also be programmable as input circuits in class A or B configurations to support dry contact or compatible two wire smoke detectors.

2.8 ADDRESSABLE NOTIFICATION MODULE

A. The contractor shall furnish and install where indicated on the plans, addressable notification modules, Honeywell Farenhyt Series Model IDP-CONTROL or SK-CONTROL. The modules shall be U.L. listed compatible with Honeywell Farenhyt Series IFP-2100ECS fire alarm control panel. The notification module must provide one class A (Style Z) or class B (Style Y) notification output with one auxiliary power input. The notification module must be suitable for mounting in a standard 4 square electrical box and must include a plastic cover plate. The notification module must provide an LED that is visible from the outside of the cover plate. The notification module must be fully programmable for such applications as required by the installation. The IDP-CONTROL or SK-CONTROL shall reside on the SLC loop and can be placed up to 5,000 feet from the control or 6815 SLC loop module.

2.9 ANNUNCIATOR

A. The main control must have a built in annunciator with a 160-character LCD display and feature LED's for Alarm, Supervisory, Trouble, Silenced and Power. When in the normal condition the LCD shall display time and date based on a 200 year clock which is capable of automatic daylight savings time adjustments. All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 in. No membrane style buttons will be permissible. The annunciator must be able to silence and reset alarms. The annunciators must have twenty levels of user codes that will allow the limitation of operating system programming to authorized individuals.

2.10 REMOTE ANNUNCIATORS

A. The fire system shall be capable of supporting remote annunciators. LCD Remote annunciator, Model RA-2000, shall have the same control and display layout so that they match identically the built in annunciator. Remote annunciators shall be available in two colors, red and light gray. Remote annunciators shall have the same functionality and operation as the built-in annunciator. All annunciators must have 160-character LCD displays and must feature five LED's for Alarm, Supervisory, Trouble, Silenced, and Power.

B. All controls and programming keys are silicone mechanical type with tactical and audible feedback. Keys shall have a travel of .040 inches. No membrane style buttons will be permitted.

C. The annunciator must be able to silence and reset alarms. The annunciator must have twenty levels of user codes that will limit the operating system programming to authorized individuals. The control panel must allow all annunciators to accommodate multiple users input

simultaneously. Remote annunciators shall be capable of operating at a distance of 6,000 feet from the main control panel on unshielded, non-twisted cable.

2.11 I/O MODULE

A. The fire system shall be able to support I/O modules (SK5880) that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs, including ECS inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be supervised and be suitable for alarm and trouble circuits as well as reset and silence switches. The system shall also support up to 40 LED drivers that reside on the two-wire SLC loop. These driver boards shall contain 80 LED outputs that are powered by an external power source.

2.12 SERIAL / PARALLEL INTERFACE

A. The fire system shall be capable of supporting up to two serial/parallel interfaces (SK5824) that are capable of driving standard computer style printers. The interface shall be programmable for the serial and parallel ports and allow printing of events as they occur.

2.13 DISTRIBUTED POWER MODULES

A. The contractor shall supply power modules, Models RPS-1000 and 5496, compatible with the IFP-2100ECS fire alarm control panel. The RPS-1000 power module must have 6 amps of output power, six Flexput™ circuits rated at 3amps each, and two form C relay circuits rated at 2.5 amps at 24 volts DC. The six Flexput™ circuits shall have the same functionality as the Flexput™ circuits on the main panel. The RPS-1000 shall be capable of being connected via an RS-485 system bus (SBUS) at a maximum distance of 6,000 feet from the main control panel. The RPS-1000 shall contain an additional RS-485 bus that is completely compatible with all IFP-2100ECS add on modules; including 6815 SLC expanders, RA-2000-SK5865-SK5880 annunciators, 5824 serial/parallel module and addressable devices. The RPS-1000 will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6,000 feet from the power module.

B. The 5496 power module must have 6 amps of output power and four circuits rated at 3 amps each. The four circuits can be programmed as notification outputs or auxiliary power outputs of door holder, constant and resettable types.

2.14 DIGITAL COMMUNICATOR

A. The digital/IP communicator must be an integral part of the control panel and be capable of reporting all zones or points of alarm, supervisory, and trouble as well as all system status information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct messages to a central station or remote station. The communicator must also be capable of up/downloading of all system programming options, event history and detector sensitivity compliance information to a PC on site or at a remote location.

B. The communicator shall transmit the information by one or more of the following means of communication – internet, cellular or standard telephone lines. The communicator must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus a 10-25 min random component to help ease traffic to the central station during a power outage. No controls that use external modems for remote programming and diagnostics shall be accepted.

2.15 DRY CONTACTS

A. The FACP will have three form “C” dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for alarm, trouble, sprinkler supervisory, notification, pre-alarm, waterflow, manual pull, aux. 1 or aux. 2. The trouble contact shall be normal in an electrically energized state so that any total power loss (AC and battery) will cause a trouble condition. In the event that the microprocessor on the FACP fails the trouble contacts shall also indicate a trouble condition.

2.16 GROUND FAULT DETECTION

A. There is a ground fault detection circuit to detect positive and negative grounds on all field wiring. The ground fault detection shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground fault will not interfere with the normal operation, such as alarm, or other trouble conditions.

2.17 OVER CURRENT PROTECTION

A. All low voltage circuits will be protected by microprocessor controlled power limiting or self-restoring polyswitches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

2.18 TEST FUNCTIONS

A. A “Lamp Test” mode shall be a standard feature of the fire alarm control panel and shall test all LEDs and the LCD display on the main panel and remote annunciators.

B. A “Walk Test” mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for 6 to 180 seconds. The FACP will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested, the zone tripped, the zone restore and the individual points return to normal.

C. A “Fire Drill” mode shall allow the manual testing of the fire alarm system notification circuits. The “Fire Drill” shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.

D. A bypass mode shall allow for any point or NAC circuit to be bypassed without effecting the operation of the total fire alarm system.

2.19 REMOTE INPUT CAPABILITIES

A. The control panel shall have provisions for supervised switch inputs for the purpose of alarm reset and alarm and trouble restore.

2.20 NOTIFICATION APPLIANCE MAPPING STRUCTURE

A. All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 999 output groups. Each of these groups shall have the ability to be triggered by any of the panels 999 zones, panel wide events, or site wide events. Additionally each zone, panel, or site will individually control the cadence pattern of each of the groups that it is mapped to so that devices can indicate a variety of conditions. The zone, panel, or site shall be capable of issuing a different cadence pattern for each of the groups under its control. The mapping structure must also allow a group to be designated to “ignore cadence” for use with strobes and other continuous input devices. Zones shall have ten different output categories; Detector Alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual Pull, Zone Auxiliary 1 and Zone Auxiliary 2, CO Alarm and CO Supervisory.

B. Each of the categories shall have the ability to control output groups with a cadence pattern. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, California Code, Zone 1 Coded, Zone 2 Coded, Zone 3 Coded, Zone 4 Coded, Zone 5 Coded, Zone 6 Coded, Zone 7 Coded, Zone 8 Coded, Custom Output Pattern 1, Custom Output Pattern 2, Custom Output Pattern 3, Custom Output Pattern 4, Constant, System Sensor Synchronization, Wheelock Synchronization, Gentex Synchronization, Amseco Synchronization, and Faraday Synchronization. This mapping/cadence pattern shall be supported by all system power supplies. 15 recordable one minute messages are available that can be mapped to eight ECS buttons. ECS messages can have priority over fire alarm outputs.

2.21 ON-BOARD PROGRAMMER

A. The FACP shall have an on board programmer which will allow for all system functions and options, except for mapping, to be programmed via the on board annunciator keypad. Any panel that does not have this capability will not be accepted.

2.22 DOWNLOADING SOFTWARE

A. The fire alarm control panel must support up/downloading of system programming from a PC. The FACP must also be able to download the detector sensitivity test results and a 1,000 event system event buffer to the PC. Communication shall take place over a direct connection to the PC and/or via the same communication method as the built in digital communicator and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or over the phone lines.

2.23 ENGLISH LANGUAGE DESCRIPTIONS

A. The FACP shall provide the ability to have a text description of each system device, input zone and output group on the system. The use of individual lights to provide descriptions will not be acceptable.

2.3 SYSTEM FUNCTIONAL OPERATION

2.3.1 ALARMS

A. When a device indicates any alarm condition the control panel must respond within 10 seconds. The General Alarm or Supervisory Alarm LED on the annunciator(s) should light and the LCD should prompt the user as to the number of current events. The alarm information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.

B. When the alarmed device is restored to normal, the control panel shall be required to be manually reset to clear the alarm condition, except that the alarms may be silenced as programmed.

C. An alarm shall be silenced by a code at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur (subsequent alarm feature). When alarms are silenced the silenced LED on the control panel, and on any remote annunciators shall remain lit, until the alarmed device is returned to normal.

2.3.2 TROUBLES

A. When a device indicates a trouble condition, the control panel System Trouble LED should light, and the LCD should prompt the user as to the number of current events. The trouble information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.

B. When the device in trouble is restored to normal, the control panel shall be automatically reset. The trouble restore information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators. A trouble shall be silenced by pressing Silence at the main panel or a code or Firefighter key at the remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur.

2.3.3 SUPERVISION METHODS

A. Each SLC loop shall be electrically supervised for opens and ground faults in the circuit wiring, and shall be so arranged that a fault condition on any loop will not cause an alarm to sound.

B. Additionally, every addressable device connected to the SLC will be supervised and individually identified if in a fault condition. The occurrence of any fault will light a Trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

C. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

PART 3 – SYSTEM COMPONENTS

3.0 CONTROL UNIT

3.1 SYSTEM CABINET MOUNTING

A. The system cabinet shall be red and can be either surface or flush mounted.

3.2 AUDIBLE SYSTEM TROUBLE SOUNDER

A. An audible system trouble sounder shall be an integral part of the control unit. Provisions shall also be provided for an optional supervised remote trouble signal.

3.3 POWER SUPPLY AND CHARGER

A. The entire system shall operate on 24 VDC, filtered switch mode power supply with the rated current available of 9 Amps. The FACP must have a battery charging circuit capable of complying with the following requirements:

1. Sixty (60) hours of battery standby with five (5) minutes of alarm signaling at the end of this sixty (60) hour period (as required per NFPA 72 remote station signaling requirements) using rechargeable batteries with automatic charger to maintain standby gel-cell batteries in a fully charged condition.

   OR

2. Twenty-four (24) hours of battery standby with five (5) minutes of alarm signaling at the end of this twenty-four (24) hour period (as required per NFPA 72 central station signaling requirements) using rechargeable batteries with automatic charger to maintain gel-cell batteries in a fully charged condition.

B. The power supply shall comply with U.L. Standard 864 for power limiting.

C. The FACP will indicate a trouble condition if there is a loss of AC power or if the batteries are missing or of insufficient capacity to support proper system operation in the event of AC failure. A "Battery Test" will be performed automatically every minute to check the integrity of the batteries. The test must disconnect the batteries from the charging circuit and place a load on the battery to verify the battery condition.

D. In the event that it is necessary to provide additional power one or more of the Model RPS-1000 or 5496 distributed power modules shall be used to accomplish this purpose.

3.4 CONNECTIONS AND CIRCUITS

A. Connections to the light and power service shall be on a dedicated branch circuit in accordance with the National Fire Alarm Code NFPA 72, California Electrical Code (CEC) NFPA 70, and the local authority having jurisdiction (AHJ). The circuit and connections shall be mechanically protected. A circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked "FIRE ALARM CIRCUIT CONTROL".

PART 4 – ACCESSORY COMPONENTS

4.1 The FACP shall support the following devices on the RS-485 data bus:

ECS-NVCM	Network Voice Control Module
ECS-SW24	Additional 24 Zone Switch Module
ECS-50W	50 Watt Amplifier
ECS-125W	125 Watt Amplifier
ECS-DUAL50W	50/100 Watt Dual Channel Amplifier with 50 Watt Backup
ECS-CE4	4 Zone Splitter
ECS-LOC	Local Operator Console (15 max.)
6815	Signaling Line Circuit Expander (SLC) Module
5824	Printer Interface Module
RA-2000	LCD Remote Annunciator
5865-3	LED Remote Annunciator
5865-4	LED Remote Annunciator with reset and silence switches
5880	LED I/O module
RPS-1000	Intelligent Distributed Power Module
5496	Intelligent Distributed Power Module

4.2 The FACP shall support the operation 159 detectors and 159 addressable modules per SLC loop without regard to device type.

The following devices shall be supported:

IDP-PHOTO	Addressable Photoelectric Smoke detector
IDP-PHOTO-T	Addressable Photoelectric Smoke detector with Thermal
IDP-PHOTOR	Addressable Photoelectric Smoke detector with Relay
IDP-FIRE-CO	Addressable Combination Photoelectric and CO Detector
IDP-HEAT	Addressable Heat Sensor
IDP-HEAT-ROR	Addressable Heat with Rate of Rise

IDP-HEAT-HT Addressable Heat High temp 190°
IDP-ACCLIMATE Addressable Multi Criteria Smoke detector with thermal
IDP-6AB 6” detector base
DNR Addressable Duct Detector Housing
IDP-RELAY Addressable Relay Module
IDP-RELAY-6 Addressable Multi Relay Module
IDP-RELAYMON-2 Addressable Relay/Input Module
IDP-MONITOR Addressable Input Module (Class A or B)
IDP-MINIMON Mini Input Module
IDP-MONITOR-2 Addressable Dual Input Module
IDP-MONITOR-10 Addressable Multi Input Module (10)
IDP-CONTROL Addressable Notification Module
IDP-CONTORL-6 Addressable Notification Multi Module (6)
IDP-ZONE Two Wire Smoke Detector Module
IDP-ZONE-6 6 Multi Smoke Detector Module
IDP-ISO Isolation Module
IDP-BEAM Addressable Beam Detector
IDP-BEAM-T Addressable Beam Detector with Test feature
B224BI Addressable Isolator base
B224RB Detector Relay Base
B200S Intelligent Detector Sounder Base
B200S-LF Intelligent Detector Low Frequency Sounder Base
RTS151KEY Remote Test Switch for Photoelectric Duct Detector
RTS151 Remote Test Switch for Photoelectric Duct Detector
IDP-Pull-SA Addressable Single Action Pull Station
IDP-Pull-DA Addressable Dual Action Pull Station
ISO-6 6 Multi Isolation Module

OR

SK-PHOTO Addressable Photoelectric Smoke detector
SK-PHOTO-T Addressable Photoelectric Smoke detector with Thermal
SK -PHOTOR Addressable Photoelectric Smoke detector with Relay
SK -FIRE-CO Addressable Combination Photoelectric and CO Detector
SK -HEAT Addressable Heat Sensor
SK -HEAT-ROR Addressable Heat with Rate of Rise
SK -HEAT-HT Addressable Heat High temp 190°
SK -ACCLIMATE Addressable Multi Criteria Smoke detector with thermal
SK -6AB 6” detector base
SK-DUCT Addressable Duct Detector Housing
SK -RELAY Addressable Relay Module
SK -RELAY-6 Addressable Multi Relay Module
SK -RELAYMON-2 Addressable Relay/Input Module
SK -MONITOR Addressable Input Module (Class A or B)
SK -MINIMON Mini Input Module
SK -MONITOR-2 Addressable Dual Input Module
SK -MON-10 Addressable Multi Input Module (10)
SK-CONTROL Addressable Notification Module
SK -CONTORL-6 Addressable Notification Multi Module (6)
SK -ZONE Two Wire Smoke Detector Module
SK -ZONE-6 6 Multi Smoke Detector Module
SK -ISO Isolation Module
SK -BEAM Addressable Beam Detector
SK -BEAM-T Addressable Beam Detector with Test feature
B224BI Addressable Isolator base

B224RB	Detector Relay Base
B200S	Intelligent Detector Sounder Base
B200S-LF	Intelligent Detector Low Frequency Sounder Base
RTS151KEY	Remote Test Switch for Photoelectric Duct Detector
RTS151	Remote Test Switch for Photoelectric Duct Detector
SK -Pull-SA	Addressable Single Action Pull Station
SK -Pull-DA	Addressable Dual Action Pull Station

A. The FACP shall support these other Honeywell devices via addressable input, addressable notification, or addressable output modules.

PS-DALOB	Dual Action Manual Pull Outdoor Listed
PS-DAH	Dual Action Manual Pull Hex Key reset
PS-SATK	Single Action Manual Pull Station – Key Reset
PS-DATK	Dual action Manual Pull Station – Key Reset
PS-DASP	Dual action Manual Pull Station “Spanish”- Key reset
SB-I/O	Surface mount back box for outdoor use.

4.3 Furnish and install, where shown on the drawings, the following devices:

4.3.1 MANUAL FIRE ALARM STATIONS

A. Manual fire alarm stations shall be non-coded, break glass, single or double action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset manual station and open FACP without use of another key. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual stations shall be constructed of die cast metal or polycarbonate with clearly visible operating instructions on the front of the stations in raised letters. Stations shall be suitable for surface mounting on matching backbox, or semi-flush mounting on a standard single-gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on manual station accessibility or per local requirements. Manual stations shall be installed in conjunction with an addressable input module, IDP-MONITOR / IDP-MINIMON or SK-MONITOR / SK-MINIMON. Manual stations shall be Honeywell Underwriters Laboratories listed.

    a. Contractor shall provide a key that fits all existing Farenhyt systems and devices in other buildings on the campus. Provide 10 qty. keys.

4.3.2 REMOTE POWER SUPPLIES

A. The remote power supplies for notification appliances shall be the Model RPS-1000 or 5496. The Model RPS-1000 intelligent power supply shall wire on the main SBUS and be programmed through the IFP-2100ECS. It will support 6 amps of 24 volt DC power with 6 Flexput™ circuits, rated at 3 amps each. Two additional 6815 SLC loop expanders shall be capable of be install in the cabinet. The power supply will also regenerate the SBUS for an additional 6000 feet of SBUS capability.

B. The 5496 intelligent power supply shall wire on the main SBUS and be programmed through the IFP-2100ECS. It will support 6 amps of 24 volt DC power with 4 notification circuits, rated at 3 amps each.

C. The remote power supply model 5499 or 5495 may also be used on the system. These power supplies are activated by a notification circuit or an IDP-CONTROL module and support 6 or 9

amps of 24VDC power, with 4 notification circuits, rated at 3amps each.

4.3.3 NOTIFICATION DEVICES

A. The visible and audible/visible signal shall be System Sensor series signal devices and be listed by Underwriters Laboratories Inc. per UL 1971 and/or 1638 and UL 464. The notification appliance (combination audible/visible units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The signaling appliance shall also have the capability to silence the audible signal while leaving the visible signal energized with the use of a single par of wires. Additionally, the user shall be able to select either continuous or temporal tone output with the temporal signal having the ability to be synchronized. The visible signaling appliance shall maintain a minimum flash rate of 1Hz or greater regardless or power input voltage. The appliance shall also be capable of meeting the candela requirements of the blueprints presented by the engineer and ADA. The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount to a single gang or double gang box or double workbox with the use of an adapter plate. The unit shall have an input voltage range of 20-30 volts with either direct current or full wave rectified power.

4.3.4 SMOKE DETECTORS

A. Smoke detectors shall be Honeywell Farenhyt Series Model IDP-PHOTO or SK-PHOTO, analog/addressable photoelectric smoke detectors. The combination detector head and twist lock base shall be U.L. listed compatible with the Honeywell IFP-2100ECS fire alarm control panel. The base shall permit direct interchange with Honeywell's IDP-ACCLIMATE / IDP-HEAT detectors or SK-ACCLIMATE / SK-HEAT detectors. The base shall be the appropriate twist lock base B210LP. The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test equipment. The vandal security-locking feature shall be used in those areas as indicated on the drawing. The locking feature shall be field selectable when required. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits. Detectors shall have completely closed back to restrict entry of dust and air turbulence and have a 30 mesh insect screen. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

4.3.5 HEAT DETECTORS

A. Furnish and install analog/addressable heat detectors, Honeywell model IDP-HEAT or SK-HEAT. The combination heat detector and twist lock base shall be U.L. listed compatible with the Honeywell IFP-2100ECS fire alarm control panel. The base shall permit direct interchange with the Honeywell Farenhyt Series IDP-PHOTO / IDP-ACCLIMATE or SK-PHOTO / SK-ACCLIMATE detectors. The base shall be appropriate twist lock base B210LP. The heat detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The vandal security-locking feature shall be used in those areas as indicated on the drawings. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

4.3.6 DUCT DETECTORS

A. Duct Detector shall be Honeywell Farenhyt Series Model DNR Duct Detector Housing. A separate IDP-PHOTO / IDP-PHOTOR or SK-PHOTO / SK-PHOTOR is required. The duct

detector housing shall be capable of housing the IDP-RELAY or SK-RELAY module for optional output devices.

4.3.7 ADDITIONAL DEVICES

A. Provide 10% Attic stock for each accessory component device type that shall be installed.

4.4 Wireless Device Fire Alarm Panel Connectivity

A. Wireless devices used as components of a fire alarm system shall be capable of connection to the IFP-2100ECS via a Signaling Line Circuit (SLC) via a gateway. The gateway shall provide the link to one mesh network of wireless devices. Multiple gateways can be supported on the same IFP-2100ECS, limited to (4) wireless mesh networks in the same radio space. All sensing functions supported for wired devices shall be supported by comparable wireless devices. Additionally, the panel shall allow wired devices to be identified with unique type codes which allow the system to display wireless trouble indications such as low battery, jamming, and tamper.

4.4.1 Wireless Reliability

A. Wireless communication for the wireless system shall incorporate an advanced mesh technology which incorporates UL 864 Class A approved supervised, redundant communication. All devices in the mesh network shall be capable of acting as repeaters for other devices in the same network. The wireless system shall also have a suite of tools that can be installed on a portable PC and used to assist in qualifying the site, installing the system, and verifying the proper operation of the system.

4.4.2 Wireless Approvals

A. The wireless system shall be approved or listed by the following agencies, as appropriate for each device:

UL
FM
CSFM
FCC

4.4.3 Addressable Wireless Devices

A. The system shall be capable of supporting addressable wireless detectors, monitor modules, and relay modules with similar appearance and capabilities as wired addressable devices.

B. Wireless devices shall utilize a gateway device to communicate with the fire alarm control panel, so that the wireless devices report to the panel using the established SLC protocol.

C. Wireless devices shall be capable of co-existing on the same panel with wired devices, and shall be capable of participating in software zone programming.

D. Device addressing for wireless device shall be consistent with wired devices, and shall use decade, decimal address switches.

E. Wireless devices (except the gateway) shall operate on batteries recommended by the manufacturer, and shall be UL tested and listed for 2 years of operation on one set of batteries.

F. The gateway shall be connected to the panel SLC loop and shall be capable of being powered by the SLC loop as well. Alternately, the gateway shall be capable of connection to the SLC loop

only for communication with the FACP, and power may be supplied via a separate 24VDC input.

G. Wireless devices shall be connected to a compatible fire alarm system, and shall be supported by the system as wireless devices. Trouble conditions that are unique to wireless devices shall be reported to the FACP built-in annunciator and all connected remote annunciators.

H. Wireless devices shall use a UL approved Class A mesh communication protocol to provide redundant supervised wireless communication links.

I. A wireless mesh shall be comprised of one gateway and from one to forty-eight wireless devices.

J. Multiple wireless gateway systems may be connected to a single FACP.

K. The system shall allow for up to four wireless gateway systems in the same radio space.

L. Device status indicators (LEDs) on wireless devices shall not be required to match indications of wired devices, in particular for active indications where a steady on LED would reduce the battery life of the device.

M. Wireless detectors shall have dedicated bases with a magnetic tamper mechanism that initiates a trouble when the device is removed from the base. The tamper trouble condition shall latch at the panel until the detector is restored to the normal installed position and the trouble has been reset.

N. Wireless monitor modules shall have a dedicated cover that requires unfastening two screws to remove. The cover shall have a built-in magnet, and removal of the cover shall initiate a trouble condition at the panel. The tamper trouble condition shall latch at the panel until the monitor module is restored to the normal installed position and the trouble has been reset.

O. Wireless monitor modules shall be capable of being mounted in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. The optional surface mount Lexan enclosure shall be used for this purpose, except where installation of the wireless monitor module in a metal box has been tested and adequate performance for the application using the metal box has been confirmed.

P. Available Wireless devices shall include:
- WIDP-PHOTO Wireless Photoelectric Smoke Detector
- WIDP-ACCLIMATE Wireless Multi-Criteria Photoelectric Smoke Detector
- WIDP-HEAT-ROR Wireless Heat Rate of Rise Detector
- WIDP-HEAT Wireless Fixed Heat Detector
- WIDP-MONITOR Wireless Monitor Module
- WIDP-RELAY Wireless Relay Module
- WIDP-WGI Wireless Gateway Module
- B210W 6” Wireless Base

OR

- WSK-PHOTO Wireless Photoelectric Smoke Detector
- WSK-PHOTO-T Wireless Photoelectric Smoke w/Fixed Heat Detector
- WSK-HEAT-ROR Wireless Heat Rate of Rise Detector
- WSK-HEAT Wireless Fixed Heat Detector
- WSK-MONITOR Wireless Monitor Module
- WSK-RELAY Wireless Relay Module
- WSK-WGI Wireless Gateway Module

- B210W 6” Wireless Base

Q. Unprogrammed wireless devices shall be capable of being used to perform a site survey to assist in determining the viability of a site for a wireless application. Tests shall include point to point connectivity, and a background RF Scan.

R. A program that supports qualification of potential wireless applications, configuration and installation, and diagnostics shall be available. This program shall be installed on a Windows® PC, and shall be capable of communicating with wireless devices by use of a USB adapter that plugs into the computer.

PART 5 – EXECUTION

5.1 Installer’s Responsibilities

A. The installer shall coordinate the installation of the fire alarm equipment. All conductors and wiring shall be installed according to the manufacturer’s recommendations. It shall be the installer’s responsibility to coordinate with the supplier, regarding the correct wiring procedures before installing any conduits or conductors.

5.2 Installation of System Components

A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA pamphlets, the requirements contained herein, California Electrical Code, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ).

B. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protection signaling circuit cable per California Electrical Code, Articles 760. For wire that meets these requirements visit www.honeywellcable.com, or equivalent.

5.3 WIRING

A. All wiring shall be in accordance with NFPA 72 and the California Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

B. All wire shall be U.L. Listed, limited energy (300 volt) FPLP or MPP wire and shall be run open in return air ceiling plenums. The wire shall be listed to U.L. TEST 910 for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction. Provide conduit in all inaccessible locations, inside concealed wall, all mechanical/electrical rooms, or other areas where wiring might be exposed and subject to damage.

C. Support wire clear of knock out panels, access panels, and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.

D. All wiring for SLC signaling circuits shall be of the twisted low capacitance type to guard against outside RF and EMF interference and induced noise.

E. All wiring shall be run in a supervised fashion (i.e. no branch wiring or dog-legged wiring) per

NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA and U.L. requirements.

F. Wiring splices shall be kept to a minimum with required splices to be made in designated terminal boxes or at field device junction boxes. Transposing or color code changes of wiring will not be permitted. End-of-line supervisory devices shall be installed with the last device on the respective circuit. Said device shall be appropriately marked designating it as the terminating device on the respective circuit.

G. No other type of low voltage wiring shall be run in the same raceway as fire alarm wiring.

H. All cabling shall be supported using bridal rings or j-hooks secured to the structure at 5' intervals.

5.4 CONDUIT / RACEWAY

A. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.

1. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.

2. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

B. Minimum Wire Sizes Shall Be As Follows:

1. Signaling Line Circuit: 18 AWG
2. Notification Appliance Circuit: 14 AWG
3. Relay Control Circuits: 18 AWG

C. Sprinkler Valves

1. Contractor shall connect all tamper switches and post indicator valves to the supervisory circuit. Connect all water flow switches to the alarm circuit. Coordinate exact locations of water vaults valves and flow switches with sprinkler contractor. Refer to site plan for vault locations.

PART 6 – FINAL TEST AND WARRANTY

6.1 TEST AND REPORTS

A. Before the installation shall be considered completed and acceptable by the awarding authority, a test of the system shall be performed as follows:

B. The contractor's job foreman, a representative of the owner, and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.

C. At least one half of all tests shall be performed on battery standby power. Where application of heat would destroy any detector, it may be manually activated. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per circuit to check for the presence of correct supervision circuitry.

D. When the testing has been completed to the satisfaction of both the contractor's job foreman and owner, a notarized letter cosigned by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the fire department.
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 by the awarding authority.

E. Prior to final test the fire department must be notified in accordance with local requirements.

F. A state licensed factory trained technical representative of the manufacturer shall perform the final control panel connections and supervise testing of the system which shall be subject to the approval of the responsible engineer and owner. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

G. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. In addition, each circuit in the system shall be fully tested for wiring supervision to insure proper wiring installation. Any items found not properly installed or non-functioning shall be replaced or repaired and re-tested. All testing shall be supervised by a licensed fire alarm superintendent.

H. The installing contractor shall provide a complete written report on the functional test of the entire system. The test and report shall verify the function of each device in the system, operation of all auxiliary control functions, and the proper operation of the main fire alarm control panel. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout.

I. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction.

6.2 WARRANTY

A. The fire alarm system shall be warrantied free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy, whichever shall occur first. Any equipment shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner.

6.3 As Built Drawings, Testing, and Maintenance Instructions

6.3.1 "As-Built" Drawings

A. A complete set of reproducible "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system.

6.3.2 Operating and Instruction Manuals

A. Operating and instruction manuals shall be submitted prior to testing of the system. Three (3) complete sets of operating and instruction manuals shall be delivered to the owner upon completion. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

END OF SECTION

SECTION 31 23 23 FILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Filling, backfilling, and compacting for building volume below grade and paving.
   2. Backfilling and compacting for utilities outside the building to utility main connections.

B. Related Sections:
   1. Section 31 22 00: Grading.

1.3 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

1.4 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill and Backfill material shall comply with the City of Westminster Standards and Specifications and the Geotechnical Report

2.2 SOURCE QUALITY CONTROL

A. See Section 01 40 00: Quality Requirements for general requirements for testing and analysis of soil material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify areas to be filled are not compromised with surface or ground water.

3.2 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

END OF SECTION 31 23 23

SECTION 31 22 00 GRADING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes regulatory requirements, protection, site grading, excavation, backfilling, compaction, quality control, and restoration.

B. Reference Standards:
1. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5 lb (2.5 Kg) Rammer and 12-inch (300 mm) Drop.
2. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.5 Kg) Rammer and 18-inch (450 mm) Drop.
4. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
5. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

1.3 SUBMITTALS

A. In accordance with the requirements of Section 6705 of the Labor Code of the State of California, submit a detailed plan to the Engineer before excavation, showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches 5 feet or more in depth.

B. Plan must be submitted and approved by the Owner and Engineer prior to start of work.

C. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Structure: Foundation, manhole, septic tank, cleanout, catch basin, vault, or culvert.

C. Solid Rock: Large continuous masses of igneous, metamorphic, or sedimentary rock, which in the opinion of the Engineer cannot be excavated without drilling and blasting. Soil that is capable of being excavated with rippers is not considered solid rock.

D. Loose Rock: Boulders and other detached stones, with a minimum volume of 1 cubic yard.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Local Public Works Department public improvement standards.

B. Contractor shall assume sole and complete responsibility for locating all underground utilities and related facilities and for protection of the same during the course of construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: See Section 31 23 23: Fill.

B. Other Fill Materials: See Section 31 23 23: Fill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey benchmarks, control points, and intended elevations are as shown on drawings.

B. Verify the absence of standing or ponding water.
1. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

3.2 PROTECTION

A. Barricade open excavations.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

C. Provide safe conditions for workers and passers-by.

3.3 PREPARATION

A. Notify Underground Service Alert (800) 227-2600 in Northern California prior to excavation. Comply with their notice requirements.

B. Identify required lines, levels, contours, and datum locations.

C. Stake and flag locations of known utilities.

D. Protect plant life, lawns, rock outcropping, and other features remaining as final landscaping.

E. Protect benchmarks, existing structures, fences, and paving from excavating equipment and vehicular traffic.

F. Maintain and protect utilities and structures to remain.

3.4 EXCAVATION

A. Classification of Excavation:
1. All excavation with equipment commonly used in the industry is classified as common

excavation (except for drilling and blasting).

B. Use open cut method on all excavation unless otherwise shown on the drawings, required by permit, or approved in writing by the Engineer.

C. Stockpile excavated material on site. Any material not utilized for construction purposes may be spread onsite or removed from the site as designated by the Engineer.

3.5 FINISH GRADING

A. Before Finish Grading:
1. Verify building and trench backfilling have been inspected.
2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

D. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

E. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.7 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.8 FIELD QUALITY CONTROL

A. A certified soils testing laboratory may be sourced to perform baseline Modified Proctor density tests in accordance with Cal 216 or latest revision:
1. Tests may be performed at locations approved by the Engineer.
2. Test results from tests prior to construction will be made available to the contractor.
3. Testing is at the Owner’s expense.

B. Compaction testing will be determined at the Engineer's discretion. See Section 31 23 23: Fill.

C. If work does not meet specified requirements, remove, replace, and retest. All re-testing is at the contractor’s expense. Compaction tests shall be used as the basis for determination of acceptability of work performed under this contract.

3.9 CLEANING

A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

3.10 PROTECTION OF FINISHED WORK

A. If vehicular traffic has altered finished work, reshape and re-compact.

END OF SECTION 31 22 00

SECTION 32 17 23 PAVEMENT MARKINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Parking lot markings, including parking bays, arrows, handicapped symbols, and curb markings.

B. Related Section:
   1. Section 02 21 00: Surveys
   2. Section 32 12 16: Asphalt Paving.
   3. Section 09 90 00: Painting and Coating.

C. Reference Standards:
   1. CBC Chapter 11B - California Building Code - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
   2. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

1.3 DEFINITIONS

A. Pavement Stripe: Includes traffic control, materials, and all appurtenances not otherwise specified.

B. Pavement Markings: Includes traffic control, setup, materials, and all appurtenances not otherwise specified in the bid schedule.

1.4 SUBMITTALS

A. See Special Provisions for Submittal Requirements.

1.5 QUALITY ASSURANCE

A. Accessible Parking:
   1. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Section 11B-208.3.1.
   2. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
   3. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. See CBC Section 11B-208.3.1.
   4. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Table 11B-208.2 for each parking facility provided on a site.
   5. For every six, or fraction of six, accessible parking spaces, at least one shall be an accessible van parking space. See CBC Section 11B-208.2.4.
   6. Accessible parking spaces and access aisles shall comply with CBC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:

a. Parking spaces and access aisles shall be marked according to CBC Figures 11B-502.2, 11B-502.3, and 11B-502.3.3. Their surfaces shall comply with CBC Section 11B-302 and shall be at the same level with slopes not steeper than 1:48 in any direction. See CBC Section 11B-502.4:
b. Parking spaces shall be 9 feet x 18 feet minimum, and van parking spaces shall be 12 feet by 18 feet minimum with an adjacent access aisle of 5 feet by 19 feet minimum. Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces. Van parking spaces shall be permitted to be 9 feet by 19 feet minimum where the access aisle is 8 feet by 18 feet minimum.
c. Access aisles shall be marked by a blue painted borderline around their perimeters. The area within the blue borderlines shall be marked with hatched lines a maximum of 36 inches on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings ay extend beyond the minimum required length. See CBC Section 11B-502.3.3.
d. Access aisles (accessible parking spaces as well – similar application) shall not overlap the vehicular way. See CBC Section 11B-502.3.4.
e. A vertical clearance of 8 feet 2 inches minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. See CBC Section 11B-502.5.

7. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with CBC Sections 11B-209 and 11B-503 as follows:
   a. Vehicle pull-up spaces shall be 8 feet by 20 feet minimum.
   b. Access aisles shall be 5 feet wide minimum x full length of vehicle pull-up spaces. They shall be at the same level with each other and with slopes not steeper than 1:48 in any direction. Access aisle shall adjoin an accessible route and shall not overlap the vehicular way.
   c. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around their perimeters. The area within the borderlines shall be marked with hatched lines a maximum of 36 inches on center in a color contrasting with that of the aisle surface: Blue interior hatch lines are preferred for concrete surfaces and white interior hatch lines are preferred for asphalt surfaces. Where white hatch lines are used, hatch lines shall be interrupted at 12 inches high “No Parking” text so that legibility is maintained.
   d. A vertical clearance of 9 feet 6 inches minimum shall be provide for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. See CBC Section 11B-503.5.
8. Bus loading zones and bus stops shall comply with CBC Sections 11B-209 and 11B-810.2 as follows:
   a. Bus boarding and alighting areas shall be of 8 feet by 5 feet minimum, with 8 feet measured perpendicular to the curb or vehicle roadway edge, and with 5 feet measured parallel to the vehicle roadway. Slopes in 9 feet direction shall be 1:48 maximum. Slopes in 5 feet direction shall be the same as that of the roadway, to the maximum extend practical. See CBC Figure 11B-810.2.2.
   b. Bus shelters shall provide a minimum 30 inches by 48 inches clear floor or ground space (36 inches by 48 inches or 36 inches by 60 inches in an alcove per CBC 11B-305.7), with slopes not steeper than 1:48 in any direction, entirely within the shelter complying with CBC Section 11B-305.
   c. Bus shelters shall be connected by an accessible route complying with CBC Section 11B-402 to a boarding and alighting area complying with CBC Section 11B-810.2 and Figure 11B-810.3.
   d. Newly constructed bus stop boarding and alighting areas shall provide a detectable transition between the boarding/alighting area and the roadway. The detectable transition shall consist of a curb with the face sloped at 35 degrees maximum from vertical or detectable warnings complying with CBC Sections 11B-705.1.1 and

11B-705.1.2.4.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Traffic Paint:
   1. Type: Water base, roadway traffic lane marking type; colors as selected.
   2. Acceptable Manufacturers:
      a. Dunn-Edwards, Vin-L-Stripe No. W-801, vinyl-epoxy as a standard of quality.
      b. J. E. Bauer latex base Formula No. 1030A9 White, No. 1056A9 Yellow, No. 1865A9 Blue, No. 1118A9 Green, and No. 1854A9 Red.
      c. Sinclair No. 160 Vinyl Traffic Line Paint, water base.
      d. Ennis Traffic Safety Solutions, product 6000 white & 6006 blue.

B. Line and Zone Marking Paint - MPI (APL) No. 97 Latex Traffic Marking Paint; white:
   1. Roadway Markings: As required by authorities having jurisdiction.
   2. Handicapped Symbols: Blue.

C. Striping: Thermoplastic Stripe, In accordance with State of California, Department of Transportation (CALTRANS), Standard Specifications, Section 84.

D. Pavement Markings: Thermoplastic Markings, In accordance with State of California, Department of Transportation (CALTRANS), Standard Specifications, Section 84.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

3.2 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.

3.3 JOB CONDITIONS

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

B. Sequencing, Scheduling: Coordinate with paving work. Verify that paint type is compatible with asphalt paving surfaces seal coats.

C. Protection: Do not apply pavement markings for seven days after application of asphalt surface seal coat. After application, protect from traffic until thoroughly dry.

3.4 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation:
1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

3.5 INSTALLATION

A. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

B. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

C. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends:
1. Apply paint in one coat only.
2. Wet Film Thickness: 0.015 inch, minimum.
3. Width Tolerance: Plus or minus 1/8 inch.

D. Parking Lots - Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings:
1. Mark the International Handicapped Symbol at indicated parking spaces.
2. Hand application by pneumatic spray is acceptable.

3.6 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to District.

END OF SECTION 32 17 23

SECTION 32 17 13 PARKING BUMPERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Precast concrete parking bumpers and anchorage.

B. Reference Standards:
1. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. ASTM C150/C150M - Standard Specification for Portland Cement.
3. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
4. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.

1.3 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

PART 2 PRODUCTS

2.1 MATERIALS

A. Parking Bumpers - Precast concrete, conforming to the following:
1. Nominal Size: 7 inches high, 12 inches wide, 6 feet long. Manufactured by Granite precast or approved equal.
2. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.
3. Concrete Materials: ASTM C330/C330M aggregate, water, and sand.
4. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size commensurate with precast unit design.
5. Air Entrainment Admixture: ASTM C260/C260M.
6. Concrete Mix: Minimum 4000 psi compressive strength after 28 days, air entrained to 5 to 7 percent.
7. Use rigid molds, constructed to maintain precast units, uniform in shape, size and finish. Maintain consistent quality during manufacture.
8. Embed reinforcing steel, and drill or sleeve for two dowels.
9. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
10. Minor patching in plant is acceptable, providing appearance of units is not impaired.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install units without damage to shape or finish. Replace or repair damaged units.

B. Install units in alignment with adjacent work.

END OF SECTION 32 17 13

SECTION 32 16 00 SITE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Section describes the requirements for providing portland cement concrete paving, including accessibility ramps, sidewalks, accessible routes of travel, vehicular travel, drain structures, sewer structures, thrust blocks and for other non-structural or non-vehicular applications.

1.2 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 45 00, Testing Lab Services.

B. Section 31 00 00, Earthwork.

1.4 QUALITY ASSURANCE

A. Use only new materials and products.

B. Use materials and products of one manufacturer whenever possible.

C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.5 SUBMITTALS

A. Refer to Section 13 33 00.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

C. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.

D. With concrete submittal, provide documented history of mix design performance.

1.6 WARRANTY

A. Refer to General Conditions and Section 01 78 36.

1.7 REFERENCES AND STANDARDS

A. California Building Code, latest edition.

B. ACI Standards, ACI 211.1, ACI 318-14, ACI 302, IR-04, ACI 301-16, ACI 305R-10, ACI 306R-16, ACI 308-16.

C. ASTM C-94, Specification for Ready-Mixed Concrete.

D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).

E. ASTM – American Society for Testing and Materials.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.

B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.

C. Transport, store and handle in strict accord with the manufacturer's written recommendations.

D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.

F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.9 TESTING

A. General: Refer to Section 01 40 00 – Quality Requirements.

B. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and DSA.

1.10 ADEQUACY AND INSPECTION

A. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.

B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.11 PROTECTION

A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work

damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.12 FIELD MEASUREMENTS

A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: Portland cement, ASTM C150, Type II, per ACI 318-14 Section 26.4.

B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.

C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 318-14 Section 26.4.1.3.1.

D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.

E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Admixture shall conform to ASTM C494 and ACI 318-14 Section 26.4.1.4.19(a). Such admixture must receive prior approval by the Architect, Structural Engineer, and the Testing Lab, and shall be included in original design mix.

F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318-14, section 26.4.1.4.

G. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.

H. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.

I. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.

J. Wire Mesh: 6”x6” #10 W.W.F. in 5’x10’ flat sheets. 6”x6” #10 wire rolls will not be accepted.

K. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3’-0” O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3” concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.

L. Truncated Domes: Vitrified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; “Armor-Tile”, “Access Tile Tactile Systems”, or approved equal.

Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B (dome spacing shall be 2.35”). Install tiles as recommended by manufacturer. Color, federal yellow (FS 33538).

M. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing compound meeting ASTM C 309 and C1315.

N. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.

O. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.

P. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed,non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.

Q. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.

R. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.

S. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893.
1. Reference Standard: ASTM C920, Grade P, Class 25, Use T.
2. Dow Corning 890-SL (self-leveling) Silicone, or accepted equal.
3. Dow Corning 888-NS (non-sagging) Silicone, at slopes exceeding 5%. May not be used at asphalt surfaces.
4. Color: Custom color as selected by Architect.

T. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8” “Snap Cap”, Tex-Trude expansion joint cap, or an approved equal.

U. Adhesive Anchoring (Epoxy): Hilty HIT-HY 200 Safe Set, or approved equal.

2.2 CONCRETE DESIGN AND CLASS

A. Class “B”: Concrete shall have 1" max. size aggregate, shall have 3000 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.

B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".

C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ASI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.

D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.3 MIXING OF CONCRETE

A. Conform to requirements of CBC, Chapter 19A.

B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.

C. Concrete shall be Ready-mixed Concrete: Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301. Batch Plant inspection may be waived in accordance with CBC Section 1705A.3.3.1, when approved by Structural Engineer and DSA.
   1. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
   2. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
   3. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.
   4. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished conforms in every particular and to proportions established by mix designs.
   5. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
   6. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.4 MATERIALS TESTING

A. Materials testing of concrete and continuous batch plant inspection may be waived in accordance CBC Sections 1704A.4.4 when approved by Structural Engineer and DSA.

B. Testing of concrete shall be performed per article 3.12 of this specification.

2.5 EQUIPMENT

A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 EXECUTION

3.1 APPROVAL OF FORMS AND REINFORCEMENTS

A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given to DSA, Architect and Structural Engineer 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.

B. All reinforcing steel and or W.W.F. shall be adequately supported by approved devices on centers close enough to prevent any sagging.

C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.

D. W.W.F. shall be lapped a minimum of 6” on each side of sheets and 12” on each end. Laps shall be wired together 2ft on center maximum spacing. End laps shall be staggered 2’-0” minimum from adjacent reinforcement.

E. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.
   1. The bars shall be placed so that there will be a minimum of 1 ½” clearance and a maximum of 3” clearance. The reinforcing steel shall be placed mid-depth of concrete slab.

F. At all right angles or intersections of concrete walks, additional 2’x2’ #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2” from concrete forms and supports at mid-depth of slab.

3.2 PROTECTION

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

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

C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05’ in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.3 CLEANING

A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.

B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.4 FORMING

A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.

B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.

C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.

D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.

E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.

F. Slope tie-wires downward to outside of wall.

G. Brace, anchor and support all cast-in items to prevent displacement or distortion.

H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.

I. Concrete paving, Curbs, Curb and Gutters, Ramps:
   1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20' for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.
   2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60' on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
   3. Isolation Joints: 3/8" felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
   4. Exterior Concrete Paving: Install expansion joints at 20' on center maximum, both directions, unless shown otherwise on plans.
   5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.
      a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
      b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.5 FORM COATING

A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.

B. Before re-using form material, inspect, clean thoroughly and recoat.

C. Seal all cut edges.

3.6 INSTALLATION

A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.

B. Placing Tolerances:
   1. Per ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.

2. Clear distance between parallel bars in a layer shall be no less than 1", the maximum bar diameter not 1 ½ times the maximum size of coarse aggregate.

C. Splices:
1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
   a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56" minimum for No. 6 bars. No. 4 bar shall have a minimum of 24" splice. 93 bar diameters for No. 7 bars and larger.
   b. All splices shall be staggered at 5 feet minimum.

3.7 INSPECTION

A. Approval of reinforcing steel, after installation, must be received from Inspector. Architect, Structural Engineer and DSA must be notified 48 hrs. in advance of beginning of concrete placement operations.

B. Slope of concrete forms and finish condition shall be checked with a two foot (2') digital level.

3.8 PLACING OF CONCRETE

A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.

B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.

C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.

D. Remove form spreaders as placing of concrete progresses.

E. Place footings as monolithic and in one continuous pour.

F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.

G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.

H. Concrete Flatwork:
1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be

true and flat with a maximum tolerance of 1/8" in 10’ for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.

2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
3. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.
4. Thoroughly water and soak the exterior slabs, curbs, curb and gutters, footing subgrades with multiple daily waterings for at least three (3) days or as required to achieve required moisture content prior to the concrete pour in order to place the subgrade soils in full expansion. Provide damming as required to keep standing water within the formed area and to allow for proper saturation and full expansion of the subgrade soils. Remove any standing water before concrete placement.

I. Placing in hot weather: Comply with ACI 305R-10. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.

J. Placing in cold weather: Comply with ACI 306R-16. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.

K. Horizontal construction joint: Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.9 CONCRETE FINISHES

A. Concrete Slab Finishing: Finish slab as required by ACI 302.1R. Use manual screeds, vibrating screeds to place concrete level and smooth. Use “jitterbugs” or other special tools designed for the purpose of forcing the course aggregate below the surface leaving a thick layer of mortar 1 inch in thickness. Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:

1. Flatwork, medium broom finish: Typical finish to be used at all exterior walks and stairs.
2. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
3. Under no circumstances can water be added to the top surface of freshly placed concrete.

B. Curb Finishing: Steel trowel.

C. Joints and Edges: Mark-off exposed joints, where indicated, with ¼” radius x 1” deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.

1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.

D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed, shall be sacked with a grout mixture of 1-part cement, 1 1/2- parts fine sand and sufficient water to produce a consistency of thick paint. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a time, then wiped or rubbed with dry burlap. Entire finishing operation of any area shall be completed on the same day. This treatment shall be carried to 4" below grade, and all patching and sacking shall be done immediately upon removal of the forms.

E. Stair Treads and Risers: Tool exterior stair tread nosing per ADA requirements and as detailed. Paint or stain tooled area at every stair tread nosing or as detailed. Stair tread nosing shall contain no pockets, voids or spalls. Patching is not allowed. Damaged nosing shall be replaced.

3.10 CURING

A. Cured Concrete in Forms: Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.

B. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations.
   1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.

C. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.

B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.

C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.

D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.

E. Defective concrete is:
1. Concrete that does not match the approved mix design for the given installation type.
2. Concrete not meeting specified 28-day strength.
3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
5. Concrete containing embedded wood or debris.
6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
7. Concrete not containing required embedded items.
8. Excessive Shrinkage, Traverse cracking, Crazing, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.

~~F.~~ Patching: Install specified Patching Mortar per manufacturer’s recommendations. REPAIRS TO DEFECTIVE CONCRETE WHICH AFFECT THE STRENGTH OF ANY STRUCTURAL CONCRETE MEMBER OR COMPONENT ARE SUBJECT TO APPROVAL BY THE ARCHITECT AND DSA.

3.12 CONCRETE TESTING

A. Comply with CBC Section 1903A, 1905A.1.16, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.

B. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.

D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class

of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.

F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

A. Remove without damage to concrete surfaces.

B. Sequence and timing of form removal shall insure complete safety of concrete structure.

C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
2. Slab edge screeds or forms: 7 days.
3. Concrete columns and beam soffits: 28 days.

D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

A. Refer to Section 01 74 00.

B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

C. Clean excess material from surface of all concrete walks and utility structures.

D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 32 16 00

SECTION 32 12 16 ASPHALT PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated in the Contract Documents and specified herein.

B. The following types of pavement shall be covered in this Section:
   1. Paving for utility trenching, parking lots, playgrounds, areas between buildings, adjacent to planting and turf areas, and as indicated on Construction Documents.

C. Related Sections:
   1. Section 31 22 00: Grading.
   2. Section 32 12 36: Seal Coats.
   3. Section 32 17 23: Pavement Markings.

1.3 SUBMITTALS

A. Mix Designs: The Contractor shall formulate a job-mix formula using the Hveem method in accordance with Standard Specifications Section 203-6.2 and submit it to the Engineer for approval. The resultant mixture shall have Hveem properties conforming to Standard Specifications Section 203-6.4.3.

B. Samples:
   1. Prior to the delivery of specified aggregate to the site, the Contractor shall submit samples of the material for the Inspector’s acceptance in accordance with Standard Specifications Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.
   2. Aggregate base gradation and quality certifications shall be dated within 30 days of the submittal.

C. Certificates:
   1. Twenty days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these specifications.
   2. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
   3. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.
   4. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

1.4 QUALITY ASSURANCE

A. The work provided herein shall conform to and be in accordance with the Standard Specifications for Public Works Construction (GREENBOOK), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

B. The Owner's inspector shall test the temperature of each batch of asphaltic concrete prior to placement. At the time of delivery to the work site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. If asphaltic concrete temperature is not within these tolerances the affected batch shall be rejected. Any and all costs due to the rejected asphaltic concrete shall be the responsibility of the paving contractor.

C. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.

D. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.

E. Regulatory Requirements: The quantity of volatile organic compounds (V.O.C.) used in weed killer, seal coat, primer and other materials shall not exceed the limits permitted under the current regulations of the local authorities having jurisdiction.

1.5 ESTABLISHMENT OF GRADES

A. The Contractor's Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the Owner. Contractor shall notify the Owner at least 48 hours before staking is to be started. The Owner will determine if work is ready for staking.

B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

C. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

D. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.

E. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10 foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

1.6 ENVIRONMENTAL LIMITATIONS

A. Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.7 PAVEMENT-MARKING PAINT

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

1.8 WARRANTY

A. The contractor shall provide a manufacturer's warranty against "aligatoring" and settlement.

PART 2 PRODUCTS

2.1 MATERIALS

A. Base Course Material: Crushed aggregate base material shall consist of materials that meet the provisions of Specifications Section 31 22 00: Grading.

B. Asphalt Surfacing Materials - Furnish asphalt surfacing meeting the following requirement, furnished from a commercial asphalt central mixing plant:
   1. Paint Binder/Tack Coat: Asphalt emulsion shall be CSS-1 or CSS-1h and shall conform to the requirements of Standard Specifications Section 203-3 Emulsified Asphalt.
   2. Asphalt Concrete Composition & Grading:
      a. Asphalt concrete shall conform to Standard Specification Section 203-6.4.3, Type C2, with asphalt content of 4.6% to 6.0%.
      b. Asphalt performance grade shall be PG-64-10.
      c. At least two courses of asphalt shall be laid when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of two inches (2").
      d. Rubberized asphalt paving is not allowed.

2.2 WEED CONTROL

A. The soils sterilant shall be in accordance with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant. Sterilant shall be selected as appropriate for the environment in which is it to be placed. Contractor shall be licensed with the State of California to apply sterilant. Sterilant shall be commercial grade for commercial application. Payment for soil sterilization will include full compensation for application and all materials and incidental work required.

B. Apply Dow Elanco Spike 80DF, or approved equal, to subgrade at all locations receiving asphalt pavement. Spike 80DF weed control should be applied at the rate of seven pounds per acre. If another manufacturer is used follow their recommendations.

C. Pavement Marking Paint:
   1. Alkyd-resin type, lead and chromate free.

D. Headers and Stakes:
   1. Headers: Pressure Treated Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on construction drawings

2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

PART 3 EXECUTION

3.1 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place

3.2 SUBGRADE PREPARATION

A. Subgrade Preparation:
   1. It is required that the native soil, and/or imported fill material, below the new aggregate base, be over excavated to the recommended minimum depth of 24” (inches). Refer to section 13.12 of the soils report for recompaction requirements. The extent and depths of removal should be evaluated by Geotechnical representative in the field based on the materials exposed. Additional removals may be recommended if loose or soft soils are exposed during grading.
   2. Prior to placement of engineered fill, the subgrade shall be scarified to a depth of at least 8 inches, moisture conditioned and recompacted to a minimum 90% relative density.

B. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual subgrade preparation will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.

C. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement structural sections, have been achieved prior to re-compaction.

D. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02’ from the specified grade and cross section established by the Engineer. Subgrade for subbase or base material shall not vary more than 0.04’ from the specified grade and cross section.

Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

E. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.

F. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.

G. Remove excess material from the site to a legal disposal area.

3.3 APPLICATION GENERAL

A. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified herein and on the Construction Documents. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.

3.4 STERILANT APPLICATION

A. Place herbicide below pavement crushed aggregate base course. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the base course. Sterilant shall not be applied within two feet of planting areas.

3.5 APPLICATION OF BASE COURSE

A. Install base course material, encompassing spreading and compacting, in accordance with the S.S.P.W.C. Section 301-2, Untreated Base.

B. Aggregate bases material shall be installed in layers not exceeding 3-inches and compacted to a minimum of 95% relative density.

C. After preparing the subgrade as specified in 3.5.A, all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the Contractor shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

D. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The Contractor shall protect the prepared subgrade from all traffic.

E. Maintain the surface in its finished condition until the succeeding layer is placed.

3.6 PLACING ASPHALT CONCRETE SURFACING

A. Asphalt binder (tack coat) shall be applied to all existing pavement surfaces to be overlaid and/or joined per section 302-5.4 of the Standard Specifications. Asphalt binder (tack coat) shall be applied to existing surfaces to be surfaced and between layers of asphalt concrete, except when eliminated by the Engineer. A layer of asphalt binder (tack coat) shall be applied to all vertical-cut faces and between subsequent AC lifts.

B. Asphalt Concrete Pavement:

1. All work shall be in accordance with Section 302-5 of the Standard Specifications, except as noted herein. Asphalt concrete work shall include full-depth patching and variable thick asphalt concrete transition areas. The Contractor shall, on a daily basis, provide the Inspector with copies of certificates of weight for all materials delivered to the job site and/or incorporated in the work. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
2. Asphalt concrete shall not be placed on any surface, which contains ponded water or excessive moisture in the opinion of the Engineer. If paving operations are in progress and rain or fog forces a shutdown, loaded trucks in transit shall return to the plant, and no compensation will be allowed therefore. The Contractor shall furnish and use canvas tarpaulins to cover all loads of asphalt from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing by the Engineer
3. The Inspector will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started.
4. Asphalt concrete of the class indicated in Section 2.B.2 shall be laid in courses conforming to S.S.P.W.C. Table 302-5.5(A) unless otherwise stated herein.
5. At least two courses shall be laid when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of two inches (2").
6. Successive courses may be laid upon previously laid courses as soon as the previous course has cooled sufficiently to show no perceivable displacement under equipment or loaded material delivery trucks and a tack coat has been applied.
7. Wherever AC pavement does not terminate against a curb, gutter, or another pavement, the Contractor shall provide and install a redwood or pressure treated Douglas fir header at the line of termination.
8. Pavement at all longitudinal joints shall have a Field Density of 95%, as described in 302-5.6.2 of the Standard Specifications. When the test results of the field cores are less than 95% Relative Compaction, the Contractor shall remove a 1 foot wide section on each side of the longitudinal joint. The Contractor shall replace the removed pavement with an asphalt mix that meets the job specification at no additional cost to the Owner.
9. Pavement tolerances: within 1/8-inch of design thickness and 1/8-inch from design elevation.

3.7 FLOOD TESTING

A. Flood Test: Before acceptance, all pavements shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. No standing water shall remain after 30 minutes on a 70 degree F (or warmer) day.

3.8 SEAL COAT

A. Allow new asphalt pavement to cure 30 days before application of seal coat. See Project Specification Section 32 12 36: Seal Coats.

3.9 FIELD QUALITY CONTROL

A. Thickness: Tolerances for asphalt pavement thickness shall be ¼ inch, plus or minus.

B. All paving shall drain properly before being accepted. Upon completion, the pavement shall

be true to grade and cross section. The asphalt substrate, shall not vary from the planned cross slope by more than +- 0.1. When a 10 foot straightedge is laid on the finished surface of the asphalt, the surface shall not vary from the edge of the straightedge more than 1/8 inch, except at grade breaks. Where paving does not meet these tolerances, the paving material shall be repaired by a method determined by the Owner. Repairs shall not be made to pavement surface by feather-edging at the join lines. All expenses for pavement repair up shall be borne by the Contractor at NO cost to the Owner.

C. Corrective Measures: It is the Contractor's responsibility to determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met the Contractor must notify the Owner in writing of the acceptance of the asphalt paving.

3.10 PROTECTION

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

3.11 CLEAN UP

A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete, or materials which will be exposed to view, shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in any discharge of contaminated materials into any catch basin. All expenses for cleanup shall be borne by the Contractor at NO cost to the Owner.

END OF SECTION 32 12 16

SECTION 32 0117

ASPHALT PAVEMENT REPAIR

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.

2. Areas heaved by tree roots, cracked areas, holes and trenches, and areas around new structures.

B. Related Sections:

1. Section 32 0113 - Rolled Slurry Seal, Existing Pavement.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, 2021 Edition.

PART 2 - PRODUCTS

2.01 BITUMINOUS MATERIALS

A. Provide materials and products of the class, grade or type indicated, conforming to relevant provisions of Section 203 - Bituminous Materials of the latest Standard Specifications for Public Works Construction.

PART 3 - EXECUTION

3.01 PAVEMENT REMOVAL

A. Remove bituminous and concrete pavement in accordance with applicable provisions of Section 300 - Earthwork of the Standard Specifications for Public Works Construction.

B. Pavement Heaved By Roots: Remove pavement to limits of distortion and expose roots. Trim roots to provide at least 12-inch clearance to pavement. Coordinate with OWNER's Tree Trimming Department for recommendations and approval prior to trimming roots.

C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes are not blackened.

D. Remove raveled and depressed bituminous pavement to limits indicated or required.

E. Saw cut existing improvements, trim holes and trenches in bituminous and concrete pavement to permit mechanical hand tampers to compact the fill.

F. Remove broken concrete by saw cutting. If the required cut line is within 30 inches of a score or joint line or edge, cut and remove to the score, joint line, or edge.

3.02 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of the adjacent undisturbed grade.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid earth a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of two 12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and devices as required to fasten headers.

3.04 BASE COURSE

A. Unless otherwise indicated, base course shall be crushed aggregate base, fine grade, 3 inches thick or equal to thickness of the existing base, whichever is greater.

B. Fill grade and compact as specified in Section 31 2200 - Grading.

3.05 RESURFACING

A. Utility Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing. Resurface flush with existing adjoining

pavement installing the same type of materials and section provided in existing improvements.

B. Other Areas: Other surface improvements damaged or removed shall be cut to a neat even line and excavated one inch below the bottom of the existing pavement. Resurface by following the original grades and installing the same type of materials provided in existing improvements.

C. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth materials before asphalt cools.

3.06 REPAIRING AND RESEALING EXISTING SURFACES

A. Preparation of Surfaces: Prior to filling cracks, clean existing bituminous surfacing of loose and foreign materials and coat with a film of asphalt emulsion.

B. Repair of Existing Surfacing:

1. Fill cracks 1/2 inch wide and less with RS-1 emulsion and washed plaster sand or other OEHS approved crack filler material. Cracks larger than ½ inch wide shall be filled with Type F/Sheet Mix Asphalt Concrete as specified. Cracks shall be filled to the level of adjacent surfacing.

2. Where low areas, holes, or depressions occur in existing surfacing, refer to Section 32 1216; Asphalt Paving, Article 3.02. Use Type E/School Mix and feather edge joint flush to the level of adjacent surfacing.

C. Testing: Flood test entire area in presence of the Project Inspector. Inspect area after waiting one hour. Entire area tested shall be free of standing water or puddles in excess of 0.01 foot. Practical field measurement: 0.01 foot = two quarters stacked.

D. Surface Seal: After surface has been repaired and tested, install seal coat over entire area indicated. Surface seal shall be as specified in Section 32 1236 - Seal for Bituminous Surfacing.

3.07 CLEANING

A. Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.

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

3.08 PROTECTION

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

END OF SECTION

SECTION 32 0113

ROLLED SLURRY SEAL, EXISTING PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Asphalt emulsion slurry seal as indicated.

B. Related Requirements:

1. Section 32 0117 - Pavement Repair.

1.02 SUBMITTALS

A. Product Data: Submit mix design.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Slurry Seal: Provide the following material grades in accordance with Section 203 - Bituminous Materials of the Standard Specification for Public Works Construction, current edition.

1. Emulsified asphalt shall be slow set type grade CSS-1h.

2. Grading of the combined aggregate and percentage of emulsified asphalt shall conform to Type I slurry requirements.

3. Installed slurry seal shall be sufficiently cured to permit vehicle traffic within one day after application.

PART 3 - EXECUTION

3.01 REPAIRING AND ROLLED SLURRY SEAL EXISTING SURFACES

A. Preparation of Surfaces:

1. Before starting slurry seal operations, existing bituminous surfacing shall be cleaned of loose material, oil spots, vegetation, and other objectionable material.

2. Dampen surface to receive slurry seal with a light application of water to ensure coverage and proper bond.

3. Provide adequate protection over manholes, yard boxes, utility vaults and other improvements adjacent to the areas to receive slurry seal. Project Inspector shall inspect surfaces before the installation of slurry seal.

B. Repair of Existing Surfacing: Cracks more than ½ inch wide, low areas, holes or depressions in existing surfacing shall be repaired as specified in Section 32 0117: Asphalt Pavement Repair, prior to the installation of slurry seal.

C. Rolled Slurry Seal: Work shall be performed in accordance to Sub-section 302-4, Slurry, of the Standard Specifications for Public Works Construction, current edition.

1. Roll slurry surfacing with a 10-ton pneumatic roller with a tire pressure of 50 psi and equipped with a water spray system. Roll as soon as the surfacing is sufficiently cured and will not pick up on tires of roller. Surfaced areas shall receive a minimum of two coverage passes by roller. Provide a smooth surface free from ridges or surface variations.

2. Depressions occurring in cracks after initial slurry seal installation shall be filled with sand slurry before rolling and seal coat installation.

3.02 CLEAN UP

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

3.03 PROTECTION

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

END OF SECTION