TETER
ARCHITECTS ENGINEERS CONNECTED

PROJECT MANUAL

CONTRACTUAL – LEGAL REQUIREMENTS
TECHNICAL SPECIFICATIONS

FOR

MERCED CITY SCHOOL DISTRICT
26TH STREET MARS/ELOP FACILITY
INCREMENT #2

Project No.: 23-13084
DSA File No.: 24-35
DSA Appl. No.: 02-123377 Inc. #2

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IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 02-123377 INC: 02
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 01/08/2026

SECTION 000107
SEALS PAGE

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SUMMARY OF WORK

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. Project information.
2. Work covered by Contract Documents.
3. Work by separate contracts.
4. Project schedule.
5. Owner furnished; contractor installed products.
6. Access to site.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and drawing conventions.

B. Related Sections:

1. Division 01 Section "Multiple Contract Summary" for clarification of the work of multiple contracts on this project.
2. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification:

Merced City School District
26th Street MARS/ELOP facility
Site Improvements & Utilities for:
1 14,000 sf district multi-use facility
1 1,500 sf storage building
2600 K Street, Merced, CA

Architect's Project Number: **24-13084**

B. Owner:

Merced City School District

444 West 23rd Street
Merced, CA

Telephone: **(209) 385-6343**
Contact: **Bryan Behan**

C. Architect:

TETER, LLP
7535 North Palm Avenue, Suite 201
Fresno, California 93711

Telephone 559.437.0887
Contact: **Chris Nikkel**

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. (1) Two-story Multi-use building with slab-on grade foundation and accompanied site work.

2. (1) Single-story Storage building with slab-on grade foundation and accompanied site work.

B. Type of Contract: Project will be constructed under multiple contracts.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. For specific contract coordination requirements, see Division 01 Section “Multiple Contract Summary.”

C. Owner will award separate contracts for the following construction operations at Project site.

1. Demolition of existing district owned building.
2. Site and Building improvements.

1.6 PROJECT SCHEDULE

1.7 PROPOSED PROECT SCHEDULE

A.	**TBD:**	**First Advertisement**
B.	**TBD:**	**Second Advertisement**
C.	**TBD @ 10:00AM:**	**First Mandatory Pre-Bid Job Walk (Required to attend only one mandatory Pre-bid Walk)**
D.	**TBD @ 10:00AM:**	**Second Mandatory Pre-Bid Job Walk (Required to attend only one mandatory Pre-bid Walk)**
E.	**TBD:**	**Last day for submission for RFI's**
F.	**TBD by 2:00 PM:**	**Issuance of Final Addenda (if required)**
G.	**TBD at 2:00 PM:**	**Bid Opening**
H.	**TBD**	**Board Meeting**
I.	**TBD**	**Anticipated Start of Contract Work** ***First Day of Limited Access for Specific Work Areas***
J.	**TBD**	**Closeout and Certification.**

1.8 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.9 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will not occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage.

Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.10 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except as otherwise indicated.

1. Submit a written request to the Architect for work hours outside of the indicted on-site hours; request subject to review by the Owner.

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

1. Notify Architect and Owner not less than 2 days in advance of proposed utility interruptions.
2. Obtain Architect’s and Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Architect and Owner not less than 2 days in advance of proposed disruptive operations.
2. Obtain Architect’s and Owner’s written permission before proceeding with disruptive operations.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed with by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes.

PART 2 - PRODUCTS (Not Used)

END OF SECTION

SECTION 011101
MULTIPLE CONTRACT SUMMARY – Needs Edit

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 a summary of the Work of each contract including responsibilities for coordination and temporary facilities and controls. Contracts include the following:

1. Demolition.
2. Site Work Contract.

B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.

C. Related Requirements:

1. Division 01 Section "Summary" for the Work covered by the Contract Documents, restrictions on use of Project site, coordination with occupants, and work restrictions.
2. Division 01 Section “Alternates” for description of alternate bids required and applicable to work of each contract.
3. Division 01 Section "Project Management and Coordination" for general coordination requirements.

1.3 COORDINATION

A. Coordinators: The Contractor for each contract shall appoint a project coordinator to be responsible for coordination of each contractor’s work with other contractors.

B. Coordination Activities: Coordination requirements shall include, but are not limited to, coordination of the following:

1. Work between contracts.
2. Access to shared or common work spaces.
3. Temporary facilities and controls.
4. Interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
5. Construction and operations of the Work with work performed by each Contract.
6. Coordination drawings in collaboration with each contractor to coordinate work by more than one contract.

7. Quality-assurance and quality-control services specified in Division 01 Section "Quality Requirements" as applicable to respective Work.
8. Sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections as applicable to respective Work.
9. Information necessary to adjust, move, or relocate existing utility structures affected by construction.
10. Locate existing permanent benchmarks, control points, and similar reference points, and establish permanent benchmarks on Project site.
11. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
12. Cutting and patching.
13. Protection of the Work.
14. Completion of interrelated punch list items.

1.4 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work of each Contract, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.

1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
2. Requirements Division 01 Specification Sections shall be applicable to each Contract for its own work.

B. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Division 01 Section "Temporary Facilities and Controls," contractor for each contract is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Its own field office, complete with necessary furniture, utilities, and telephone service.
4. Its own storage and fabrication sheds.
5. Temporary enclosures for its own construction activities.
6. Staging and scaffolding for its own construction activities.
7. General hoisting facilities for its own construction activities.
8. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
9. Progress cleaning of work areas affected by its operations on a daily basis.
10. Secure lockup of its own tools, materials, and equipment.
11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

1.5 MODULAR BUILDINGS CONTRACT

A. Work of the Modular Buildings Contract includes, but is not limited to, the following:

1. Modular building as specified in Division 13 Section “Prefabricated Modular
2. Structures.”
3. Structural design and preparation of delegated design submittal/construction documents through California Division of the State Architect Approval.
4. Title 24 Lighting Compliance based upon selected light fixtures and controls.
5. Concrete foundations for modular buildings including building footings, formwork, reinforcing steel and concrete, subject to Alternate Bids requirements.
6. Under-building utilities (extend 5 feet beyond the building)
7. Off-site and on-site construction of modular building.

1.6 SITE WORK CONTRACT

A. Work of the Site Work Contract includes, but is not limited to, the following:

1. Remaining work not identified as work under other contracts.
2. Selective demolition of selected site improvements as indicated on Drawings and as necessary to accommodate the Work.
3. Site preparation: site clearing, earthwork including over excavation and backfill for construction of building pads for modular buildings and rubberized surface.
4. Pad prep, footing excavation and haul off to be scope of site work contract.
5. Concrete foundations for modular buildings including building footings, footing excavation, formwork, reinforcing steel, termiticide and concrete, subject to Alternate Bids requirements.
6. Under-building utilities (extend 5 feet beyond the building) subject to Alternate Bids requirements.
7. Site improvements, including fencing, parking lots and pedestrian paving.
8. Site utilities, trenching, backfill, and patching.

B. Temporary facilities and controls of the Site Work Contract include, but are not limited to, the following:

1. Temporary facilities and controls that are not otherwise specifically assigned to other contracts.
2. Sediment and erosion control.
3. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
4. Project identification and temporary signs.
5. General waste disposal facilities.
6. Temporary fire-protection facilities.
7. Barricades, warning signs, and lights.
8. Site enclosure fence.
9. Security enclosure and lockup.
10. Environmental protection.
11. Restoration of Owner's existing facilities used as temporary facilities.

C. Plumbing Work of the Site Work Contract includes, but is not limited to, the following:

1. Site water distribution, sewers, and storm drainage as indicated on the drawings.
2. Site water distribution shall be extended and connected to points of connection for modular buildings.
3. Under-building utilities (extend 5 feet beyond the building), subject to Alternate Bids requirements.

D. Electrical Work of the Site Work Contract includes, but is not limited to, the following:

1. Site electrical distribution.
2. Site communications and security.
3. Electrical service and distribution.
4. Under-building utilities (extend 5 feet beyond the building), subject to Alternate Bids requirements.

1.7 CONTRACT COMPARISON

A. Work outside of the modular buildings shall be the responsibility of the Site Work Contractor; Work interfacing with and relating to the modular building and Site Contractor work shall be the responsibility of the Contracts as indicated on the drawings and as follows:

	Spec Section / Work Item	**Modular Buildings**	**Site Contractor**			**Comments**
1.	Division 01 Sections	X	X			As applicable to the work of each contract for its own work.
2.	014000 Quality and Testing Requirements: General	X	X			As applicable to the work of each contract for its own work.
3.	014000 Quality and Testing Requirements: Concrete testing for slabs & footings	X	X			As applicable to the work of each contract for its own work.
4.	015000 Temporary Facilities and Controls	X	X			See Division 01 Section Temporary Facilities and Controls, Responsibility Matrix.
5.	024109 Selective Demolition		X			As indicated on Drawings.
6.	033000 Cast-in-Place Concrete: Modular foundations	X	X			Base Bid: By Modular Building Contractor Bid Alternate: by Site Contractor
7.	093000 Tiling: Exterior porcelain tile	X	X			Base Bid: Modular Building Contractor Bid Alternate: FRP
8.	101400 Signage: Signs for room or space identification		X			As indicated on Drawings
9.	23000 Plumbing: Under building utilities (within 6 inches of building perimeter)	X	X			Base Bid: Modular Building Contractor Bid Alternate: Site Contractor

	Spec Section / Work Item	Modular Buildings	Site Contractor			Comments
10.	Division 26 Electrical: Power distribution to and connection of power modular building.		X			As indicated on Drawings.
11.	Division 27 Communications: Building security and IT devices and systems within modular building	X	X			Rough-in (conduit and boxes) by Modular Building Manufacturer. Wiring, devices, and fixtures by Site Contractor
12.	Division 28 Fire Alarm: Fire alarm system within modular building	X	X			Rough-in (conduit and boxes) by Modular Building Manufacturer. Wiring, devices, and fixtures by Site Contractor
13.	311100 Site Clearing: Site Clearing		X			
14.	312000 Earthwork: Over excavation, fill, and compaction, finish grading of soil in vicinity of building and termiticide treatment. in the area of modular buildings.		X			
15.	312000 Earthwork: Excavation limited to modular building footings, removal of excess soil.		X			
16.	321313 Concrete Paving and Walks: Concrete paving, walks and under building concrete slurry		X			

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011103
ADDENDA

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 requirements for Addenda issued prior to bid opening.

B. Related Requirements:

1. Division 00 Sections as applicable to contract requirements and modifications.
2. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
3. Division 01 Section "Contract Modification Procedures" for changes to the Contract Documents after award of the Contract.

1.3 NOTICE TO BIDDERS

A. Addenda will be issued to registered plan holders for changes to the drawings and specifications during the bidding period prior to the bid opening. Addenda shall serve to clarify, revise, and supersede information in the Project Manual, Drawings, and previously issued Addenda. Portions of the Addenda affecting the Contract Documents will be incorporated into the Contract by enumeration of the Addendum in the Owner/Contractor Agreement.

B. The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Bid Form.

1.4 GOVERNING AGENCY REVIEW AND APPROVAL

A. Addenda shall be submitted to The Division of the State Architect (DSA) by the project Architect and shall be approved by the DSA in order to be officially incorporated into the construction documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011105
USE OF ARCHITECT'S ELECTRONIC FILES

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 use of Architect's electronic Contract Document drawing files.

B. Related Sections:

1. Division 01 Section "Project Management and Coordination."
2. Division 01 Section "Submittal Procedures."
3. Division 01 Section "Project Record Drawings."

1.3 USE OF ARCHITECT'S ELECTRONIC FILES

A. Architect may make available to Contractor digital data files of Architect's Drawings for use in preparing shop drawings, coordination drawings, and project record drawings.

1. Electronic files will be available without charge.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
3. Files will be supplied digitally via email or FTP site and will be in PDF, DWG, or similar common format.
4. Waiver of Liability: Contractor, Subcontractors, and Suppliers of this Project shall each execute a waiver of liability for each use of the Architects electronic files.
    a. Waiver of Liability form shall be submitted to the Architect at the time or request for use of Architect's electronic data files.
    b. Waiver of Liability form shall be the "ELECTRONIC DATA FILE DISTRIBUTION WAIVER OF LIABILITY FORM" included at the end of this Specification Section.
    c. The use of the electronic files shall only be used for this Project and for the identified purposes noted in the Waiver of Liability form.
        1) Each entity shall be responsible for complying with the restrictions of the Liability Waiver form.
        2) Electronic Contract Document drawing files received from the architect shall not be duplicated without written permission of the Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

(Electronic Data File Distribution Waiver of Liability included on the following page)

TETER, LLP
ARCHITECTS ENGINEERS CONNECTED

ELECTRONIC DATA FILE DISTRIBUTION WAIVER OF LIABILITY

TETER, INC
7535 North Palm, Suite 201
Fresno, California 93711

Project: _____

Intended Use: _____

Any electronic data, files or information provided under this Agreement are the property of the above listed Professionals and consultants (Team). It is understood and agreed that the information contained in these electronic data file shall not be copied or duplicated for any use other than the project for which they were created. It is understood by the undersigned that compatibility of this electronic media with other systems is not guaranteed, and conversion to other systems is done at the user's own risk.

The user hereby agrees and recognizes that designs, plans and data stored on electronic media including, but not limited to, computer disk and magnetic tape, may be subject to undetectable alteration and/or uncontrollable deterioration. It is agreed by the undersigned that the Team shall not be liable for the completeness or accuracy of any material provided on electronic media.

The undersigned agrees to defend, hold harmless and indemnify the Team and its officers, directors, employees, agents and consultants for any and all claims, losses, costs or damage whatsoever arising out of, resulting from, or in any way related to the use of electronic data files provided hereunder, whether that use is authorized or unauthorized. The user further agrees to defend, indemnify and hold harmless the Team its officers, directors, employees, agents and consultants from any and all claims, damages, losses, expenses and injuries arising out of the modification of the electronic data files by the user or by anyone obtaining said files through or from the user.

The Team bears no responsibility for the information in the electronic data files once it leaves the offices of **TETER**, LLP. The undersigned understands that the electronic data files are subject to applicable copyright laws of the United States and agrees to be bound by same. Upon our receipt of this agreement duly executed by an Officer of your firm you may request the Data files.

Name (Print/Sign): _____ Date: _____

Firm: _____ _____

Phone and email: _____ _____

Name (Print/Sign): _____ Date: _____

Firm: _____ _____

Phone and email: _____ _____

Name (Print/Sign): _____ Date: _____

Firm: _____ _____

Phone and email: _____ _____

SECTION 012300
ALTERNATES

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 alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule of Alternates: A schedule of alternates is included in Part 3 Article “Schedule of Alternates” at the end of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: N/A

1. Base Bid: N/A

2. Bid Alternate: N/A

B. Alternate No. 2: N/A

1. Base Bid: N/A

2. Bid Alternate: N/A

C. Alternate No. 3: N/A

1. Base Bid: N/A

2. Bid Alternate: N/A

END OF SECTION

SECTION 012500
SUBSTITUTION 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 substitutions.

B. Related Sections:

1. Division 00 Section “Instructions to Bidders” and other Division 00 Sections as applicable to substitution requests prior to submission of bids.
2. Division 01 Section “DSA Hourly Fee Services” for DSA hourly fee services for review of changes to DSA approved Construction Documents.
3. Division 01 Section “Contract Modification Procedures” for changes to DSA approved Construction Documents.”
4. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
5. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. 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.
2. Substitutions for Convenience: Changes proposed by Contractor that are not required in order to meet other Project requirements but may offer advantage to the Owner.

1.4 REGULATORY REQUIREMENTS

A. Division of the State Architect (DSA) Review and Approval: Substitutions resulting in changes to DSA approved Construction Documents may be considered a change requiring DSA review and approval and submission of a DSA Construction Change Document (CCD) form by the Architect.

1. DSA Construction Change Documents shall be as specified in Division 01 Section “Contract Modification Procedures.”
2. DSA Hourly Fee Services for review of CCD’s shall be as specified in Division 01 Section “DSA Hourly Fee Services.”

1.5 SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title, and Drawing numbers and titles.

1. Substitution Request Form: Use form provided at the end of this Section.
2. Documentation: 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 modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. 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.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 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 7 days of receipt of additional information or documentation, whichever is later. Architect will not act on any Post-Bid Substitutions until 7 days following the submission of the Schedule of Values per Division 01 Section “Payment Procedures.”

a. Forms of Acceptance:

1) Substitutions Prior to Bid: Addenda will be issued for substitutions accepted prior to bid.
2) Substitutions After Award of Contract: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Archi2tect does not issue a decision on use of a proposed substitution within time allocated.

1.6 QUALITY ASSURANCE

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

1.7 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions Prior to Bid: Architect will consider requests for substitution if received within 21 days prior to the submission of bids. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider bidder’s request for substitution when the following conditions are satisfied.

a. Substitutions prior to bid shall also be subject to the requirements of applicable Division 00 Specification Sections.
b. Substitutions prior to bid shall comply with the requirements for Substitutions for Cause or Substitutions for Convenience as applicable.

2. Substitutions requested by bidders during the bidding period, and accepted by Addendum prior to award of the Contract, are considered as included in the Contract Documents.

B. Substitutions After Award of Contract: The Contractor after award of the Contract, as allowed by the General Conditions, may submit materials and methods to be considered for substitutions.

1. The following are not considered to be substitutions:

a. Revisions to the Contract Documents requested by the Owner or Architect.
b. Specified options of products and construction methods included in the Contract Documents.
c. The Contractor’s compliance with governing regulations and orders issued by governing authorities.

C. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 21 days prior to time required for preparation and review of related submittals.

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

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.

D. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

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

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)

END OF SECTION

(Substitution Request Form included on the following page)

TETER, LLP
ARCHITECTS ENGINEERS CONNECTED

SUBSTITUTION REQUEST FORM

FOR: 24-13084 MCSD 26th STREET MARS/ELOP FACILITY

We hereby submit for your consideration the following product instead of the specified item for the above project:

SECTION	PARAGRAPH	SPECIFIED ITEM
_____	_____	_____

Proposed Substitution: _____

Attach complete technical data, including laboratory tests, if applicable.

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proposed installation.

Fill in the blanks below:

A. Does the substitution affect dimension on Drawings:

_____

B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?

_____

C. What affect does substitution have on other trades?

_____

D. Difference between proposed substitution and specified item?

_____

E. Manufacturer's guarantees of the proposed and specified items are:

_____ Same _____ Different (explain on attachment)

F. Cost difference between proposed substitution and specified item - savings to Owner?

_____

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item and will be at no additional cost to the Owner.

Submitted to the Architect by:

Signature: _____

Firm: _____

Address: _____

_____

Date: _____

Telephone: _____

For Use by Design Consultant

Accepted _____
Accepted as Noted _____
Not Accepted _____
Received Too Late _____

By: _____

Date: _____

Remarks: _____

SECTION 012600
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 including the following:

1. Governing Agency approval.
2. Bulletins.
3. Architect’s Supplemental Instructions.
4. Architect’s Change Directive.
5. Requests for Proposals.
6. Change Order Requests.
7. Cost Change Directives.
8. Change Orders.

B. Related Requirements:

1. Division 00 Sections as applicable to contract requirements and modifications.
2. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
3. Division 01 Section “DSA Hourly Fee Services” for fees charged by DSA for changes to the Construction Documents.

1.3 DEFINITIONS

A. Contract Modification: A change to the Contract Agreement between the Owner and the Contractor affecting the Contract Documents, the Contract Time, and/or the Contract Amount.

1.4 GOVERNING AGENCY APPROVAL

A. DSA Approval: Changes to DSA approved Construction Documents shall be reviewed and approved by DSA.

1. Changes to DSA Approved Construction Documents shall comply with requirements of DSA Interpretive Regulation IR A-6, “Construction Change Document Submittal and Approval Process” and shall be accompanied by DSA Form 140 “Application for Submittal of Post-Approval Document.”
2. Architect shall be responsible for preparing Construction Change Documents and submitting documentation to DSA.

B. DSA Hourly Fee Services: Changes to DSA approved Construction Documents shall be reviewed by DSA and shall be subject to DSA Hourly Fee Services. Charges will be made to the Owner by DSA.

1. Where changes to DSA approved Construction Documents are the result of actions by the Contractor, the Contractor shall be liable for DSA Hourly Fee Services as described in Division 01 Section “DSA Hourly Fee Services.”

1.5 BULLETINS

A. Bulletins: A form used by the Architect for issuing Architect’s Supplemental Instructions (ASI), Architect’s Change Directives (ACD), and Requests for Proposals (RFP).

1.6 ARCHITECT’S SUPPLEMENTAL INSTRUCTION

A. Architect’s Supplemental Instruction (ASI): Supplemental instructions will be issued by the Architect authorizing minor changes in the Work not involving adjustment to the Contract Sum or the Contract Time.

1. Architect’s Supplemental Instructions will be issued via Bulletin and signed by the Architect.
2. Contractor’s Response: Contractor shall perform the work indicated in the Architect’s Supplemental Instruction without adjustment to the Contract Sum or the Contract Time. If the Contractor determines that an adjustment to the Contract Sum or the Contract Time is necessary due to the Architect’s Supplemental Instruction, the Contractor shall respond to the Architect’s Supplemental Instruction as if it were an Architect/Owner initiated Request for Proposal.

B. DSA Review and Approval: Architect’s Supplemental Instructions affecting changes to the DSA Approved Construction Documents shall be subject to DSA review and approval; Architect shall submit applicable DSA CCD documentation to DSA for approval.

1.7 ARCHITECT'S CHANGE DIRECTIVE

A. Architect's Change Directive (ACD): Architect's Change Directives will be issued by the Architect instructing the Contractor to proceed with a change in the Work for subsequent inclusion in a Change Order.

1. Architect's Change Directives will be issued via Bulletin and signed by the Architect.
2. Architect's Change Directives contain a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation by Contractor: Maintain detailed records on a time and material basis of work required by the Architect's Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

C. DSA Review and Approval: Architect's Change Directives affecting changes to the DSA Approved Construction Documents shall be subject to DSA review and approval; Architect shall submit applicable DSA CCD documentation to DSA for approval.

1.8 REQUEST FOR PROPOSALS

A. Requests for Proposals: Requests for Proposals are Architect/Owner initiated requests for estimates of changes to the Contract Sum and/or Contract Time for proposed changes; Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. The description may include supplemental or revised Drawings and Specifications.

1. Requests for Proposals will be issued by the Architect via Bulletin.
2. Requests for Proposals are not authorization or instructions to either stop work in progress or execute proposed change(s).
3. Contractor's Response: Within not more than 7 days after receipt of Request for Proposal, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

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

B. Architect’s Response: Within 7 days after receipt of Contractor’s response to Architect/Owner initiated Request for Proposal, Architect will:

1. Issue a Change Order or Cost Change Directive for accepted proposals.
2. Notify the Contractor of unaccepted proposals.
3. Issue an Architect’s Change Directive where changes are necessary for the progress of the Work and changes to the Contract Sum and the Contract Time are in dispute.

1.9 CHANGE ORDER REQUEST

A. Change Order Request (COR): Change Order Requests are documents initiated by the Contractor requesting a Contract Modification due to unforeseen conditions, or latent or changed conditions.

1. Change Order Request Form: Use form acceptable to Architect.
2. Include a statement outlining reasons for the Change Order Request and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
3. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
5. Include costs of labor and supervision directly attributable to the change.
6. 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.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

B. Architect’s Response: Within 7 days after receipt of Contractor’s Change Order Request, Architect will:

1. Issue a Cost Change Directive for accepted Change Order Requests that do not require changes to the approved Construction Documents.
2. Issue a Change Order and/or Cost Change Directive for accepted Change Order Requests that require changes to the approved Construction Documents.

    a. Where Change Order Requests require changes to the Contract Documents, Architect will provide a detailed description of proposed changes in the Work via Change Order.

3. Issue an Architect’s Change Directive where changes are necessary for the progress of the Work and changes to the Contract Sum and the Contract Time are in dispute.
4. Notify the Contractor of unaccepted proposals.

1.10 COST CHANGE DIRECTIVE (CCD)

A. Cost Change Directive: A Cost Change Directive is a document issued by the Architect notifying Contractor of Owner’s acceptance of changes to the Contract Sum proposed by the Contractor.

1.11 CHANGE ORDERS

A. Change Orders: Change orders are a document defining Contract Modifications; upon Owner's approval of proposed Contract Modifications, Architect will issue a Change Order for signatures of Owner and Contractor on form provided by Architect.

B. DSA Review and Approval: Change Orders affecting changes to the DSA Approved Construction Documents shall be subject to DSA review and approval; Architect shall submit applicable DSA CCD documentation to DSA for approval.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012605
DSA HOURLY FEE 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.

B. Division of the State Architect (DSA) Interpretive Regulation IR A-30 “DSA Hourly Fee Services” latest edition (Document is available on DSA’s website under “Publications;” Interpretations of Regulations (IRs); A- Administrative; IR A-30).

https://www.dgs.ca.gov/dsa/

1.2 SUMMARY

A. Section includes administrative and procedural requirements for DSA Hourly Fee Services associated with changes to DSA approved Construction Documents.

B. Related Requirements:

1. Division 00 Sections as applicable to contract requirements and modifications.
2. Division 01 Section "Addenda."
3. Division 01 Section "Substitution Procedures."
4. Division 01 Section "Contract Modification Procedures."
5. Division 01 Section "Payment Procedures."
6. Division 01 Section "Submittal Procedures."
7. Division 01 Section "Product Requirements."

1.3 DSA HOURLY FEE SERVICES

A. General: Changes to DSA approved Construction Documents shall be documented by the use of DSA Construction Change Document (CCD) forms. CCD forms shall be submitted to DSA by the Architect.

1. Refer to Division 01 Section “Contract Modification Procedures” for additional information regarding DSA CCD’s.

B. DSA Hourly Fee Services: Changes to DSA approved Construction Documents shall be reviewed by DSA and shall be subject to DSA Hourly Fee Services for review at a rate established by DSA IR A-30. Charges will be made to the Owner by DSA.

1. Hourly Rate: Rate per hour as established by DSA IR A-30, latest edition.

C. Bidder's Responsibility: Prior to bidding, where a bidder's request for substitution or similar action results in a change requiring DSA Hourly Fee Services, bidder shall submit a deposit to the Architect for reimbursement for DSA Hourly Fee Services. The deposit amount shall be established by the Architect, a minimum of one hour of DSA Hourly Fee Services (hourly rate as established by DSA IR A-30) will not be refundable. Deposits shall be made payable to the Owner.

D. Contractor's Responsibility: When a contractor's action results in a change requiring DSA Hourly Fee Services, charges by DSA to the Owner will be deducted from the Contract Sum and the Architect will issue a Change Order on a quarterly basis to adjust the Contract Sum.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012613
REQUEST FOR INFORMATION

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 provisions for preparation, submittal and response to Contractor’s Request for Information (RFI’s) during construction of project.

1.3 DEFINITIONS

A. RFI, Request for Information: Request from Contractor seeking information required by or clarification of the Contract Documents.

1.4 SUBMITTALS

A. RFI Submittals: Submit RFI’s via email as PDF electronic files; include attachments in PDF electronic file format.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Form: Use RFI form included at end of this Section or form acceptable to Architect. Upon request from the Contractor, the form at the end of this section will be made available in WORD format from the Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond.

1. Allow 10 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
2. Architect will not act on any RFI’s until 7 days following the submission of the Schedule of Values per Division 01 Section “Payment Procedures.”
3. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor’s means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

4. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
5. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

6. Distribution: The Architect shall distribute one electronic copy of each completed RFI review to the Contractor and the Owner.

E. Regulatory Requirements: Architect's responses that modify the Contract Documents affecting Structural Safety, Fire and Life Safety, and/or Access Compliance shall be submitted to the Division of the State Architect for review and approval.

1. Changes to DSA approved Construction Documents shall be as specified in Division 01 Section "Contract Modification Procedures."

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the sequential RFI number. Submit log weekly unless otherwise directed in writing by Architect. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

H. Contractor's Expense for RFI's: Architect will review and respond to legitimate RFI's at no additional cost to the Contractor. RFI's determined by the Architect to be flagrant or unnecessary will have the expense for the Architect's time paid by the Owner with the amount being deducted from the Contract Sum. The expense will be based on an hourly rate in accordance with the Architect's standard hourly rate schedule in effect at the time the work is performed with a minimum of one hour for each flagrant or unnecessary RFI.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

(REQUEST FOR INFORMATION form included on the following page)

TETER
ARCHITECTS ENGINEERS CONNECTED

REQUEST FOR INFORMATION

Project:
24-13084
MCSD 26TH STREET
MARS/ELOP

From:

Client Project No.

DSA File No.

DSA Appl No.

Date:

Request for Information No. _____

☐ Deviation from Contract Docs

☐ Correction of Non-Compliant Work

To:
TETER
7535 N. Palm Avenue, Ste. 201
Fresno, CA 93711

Drawing:_____

Detail No._____

Specification:_____

Addendum:_____

Respond by:

Priority
(Low) 1 2 3 4 5 (High)

Subject: _____

Information Requested:

Contractor's Recommendation:

Probable Cost Effect: _____ Probable Time Effect: _____

Architect's Response:

Disclaimer
The work shall be carried out in accordance with the above supplemental instructions pursuant the Contract Documents, without change in the Contract Sum or Contract Time. Proceeding with the Work, according to these instructions, indicates your acknowledgement that there will be no change in the Contract Sum or Contract Time. If the Contractor considers that this response requires a change in the Contract Sum or Contract Time, the Contractor shall not proceed with this Work and shall promptly submit an item proposal.

SECTION 012900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections:

1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
3. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.

    a. Architect will not act on any RFI's, Post-Bid Substitutions, and/or changes to the project scope, cost, or schedule until 7 days following the submission of the Schedule of Values.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Labor.
        2) Materials.
        3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of 5 percent of Contract Sum.

    a. Include separate line items under Contractor and principal subcontracts for project closeout requirements in an amount totaling 5 percent of the Contract Sum and subcontract amount.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

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

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment application shall be as indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

    1. If dates and periods are not indicated in the Agreement between Owner and Contractor at time of bidding, the date for Application for Payment shall be established by the Owner to correspond with the Owner’s administrative procedures in order to allow for processing and approval of Application for Payment. The period of construction work covered by each Application for Payment shall be one month.
    2. Submit draft copy of Application for Payment 7 days prior to due date for review by Architect.

C. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Materials previously stored and included in previous Applications for Payment.
    b. Work completed for this Application utilizing previously stored materials.
    c. Additional materials stored with this Application.
    d. Total materials remaining stored, including materials with this Application.

F. Transmittal: Submit 6 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Submittal schedule (preliminary if not final).
5. List of Contractor's staff assignments.
6. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
7. Initial progress report.
8. Report of preconstruction conference.

I. Application for Payment at Substantial Completion: After issuance of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portions of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Updated final statement, accounting for final changes to the Contract Sum.
3. Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013113
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 administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination drawings.

B. Related Sections:

1. Division 01 Section "Project Meetings" for project meetings.
2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.
5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 SUBMITTALS

A. List of Key Personnel Names: Within 15 calendar 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 their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

B. Coordination Drawings:

1. Initial Submittal: Submit digital PDF document of each coordination drawing for each condition where Coordination Drawings are required.
2. Project Closeout:

    a. Submit 3 printed “Record” copies of each coordination drawing for each condition where Coordination Drawings are required.
    b. Submit “Record” electronic coordination drawing files.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components 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 such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: 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.

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

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely indicated 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. Coordination Drawings shall include the work of multiple trades on the same drawing. Where applicable, provide coordination drawings for the following:

1. Utility connections for building services.
2. Utility connections for equipment.
3. The crossing of multiple underground utilities.
4. Equipment installations and required service space with adjacent construction.
5. Work above ceilings including but not limited to lighting fixtures, ductwork, fire sprinkler piping, mechanical equipment, and building structure.

B. Content: 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:
1. 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.
2. Coordinate the addition of trade-specific information to the coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
3. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
4. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
5. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
6. Indicate required installation sequences.
7. 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.
8. 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.

9. Electrical Work: Show the following:

a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

10. Fire-Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

C. Coordination Drawings: Where Project conditions necessitate coordination drawings, provide coordination drawings as follows:

1. Overhead Work and Work Above Finished Ceilings: Indicate framing for support of ceiling and wall systems, conduit and piping runs, plumbing, mechanical, and electrical equipment, and related Work. Locate components to accommodate layout of light fixtures indicated on Drawings. Show the work of each trade including, but not limited to, pipe runs, mechanical ductwork, cable trays, conduit runs, and bracing and supports.

a. Indicate locations of all dampers, valves, cleanouts and other devices requiring human access for maintenance and repair. Where access panels are required, show locations and indicate size.
b. Show the height above finish floor each item, demonstrating sufficient space for installation and maintenance. Indicate sizes of ducts, piping and similar items.
c. Layout of work shall be done in such a manner to avoid conflicts between the work of different trades, finish ceiling heights, soffits, light fixtures or other finish work at ceilings and soffits.
d. Should unavoidable conflicts occur that affect finish ceiling and soffit heights, methods of installations, methods of construction or means of accessibility, the contractor shall clearly identify each location for review by the Architect.

2. Equipment Rooms and Outdoor Service Yards: Show work above and below grade including mechanical, plumbing, fire protection, fire alarm, and electrical equipment, and related supports, accessories, and utility connections. Include the following information:

a. Equipment: Show equipment and locations, utility connections, and working and service clearances.

b. Utilities: Show above and below grade utilities; indicate heights and below grade elevations, sizes of piping and conduit, dimensions between utilities and between utilities and other obstructions including concrete footings for other work. Show locations of all shut-off and isolation valves, cleanouts, filters, and other devices requiring human access for maintenance and repair.
c. Enclosures: Show limits of enclosure including walls, doors, fences, and gates; confirm door and gate access width for equipment.
d. Dimensions: Indicate dimensions as appropriate to insure adequate clearance will be provided for installation, service, and operation of equipment; include horizontal and vertical dimensions between utilities to insure clearance for installation of utilities. Include vertical dimension(s) of equipment and distances to overhead obstructions where applicable.

3. Roof Mounted Equipment: Show equipment that will be located on the roof, include the following:

a. Equipment locations and horizontal distances between equipment.
b. Locations of roof penetrations, sizes of penetrations, and indicate the horizontal distance between penetrations and roof mounted equipment.
c. Pipe and conduit runs including locations and type(s) of supports.
d. Distance between all roof mounted equipment and roof drainage features. Equipment shall be located so as to not obstruct roof drainage; provide at least 24 inches between equipment platforms and valleys formed by the intersection of roof planes and crickets.

4. Underground Site Utilities and Utilities Below Slabs on Grade within Building Areas: Where underground utilities cross other utilities, penetrate footings, underground structures or other obstructions; show the work that will be placed underground; include the following information:

a. Indicate types and sizes of utility piping and elevations below grade.
b. Show footings and other underground structures; where unavoidable conflicts occur between underground structures/footings and utilities, indicate depths below grade and clearly identify locations for sleeving for review by Architect.

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.

D. Coordination Drawing Digital Data Files: Prepare coordination digital data files according to the following requirements:

E. Coordination Drawing Digital Data Files: Submit digital coordination drawing files using PDF format.

1. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Digital Data Software Program: Drawings are available in PDF format.
c. Contractor shall execute a data licensing agreement as required by Division 01 Section “Use of Architect’s Electronic files.

F. Review: Architect will review coordination drawings to confirm that, in general, 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 suitable modifications and resubmit.

G. Resolution of conflicts occurring in the Work after Coordination Drawings have been prepared shall be the responsibility of the Contractor. Contractor shall bear all costs associated with resolution of conflicts including additional contract time, architectural and engineering services fees, and loss of use to the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013119
PROJECT MEETINGS

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 provisions for project meetings, including, but not limited to, the following:

1. Preconstruction conferences.
2. Preinstallation conferences.
3. Progress meetings.
4. Project Closeout Conference.

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

1. Division 01 Sections as applicable to project management.

1.3 PRECONSTRUCTION CONFERENCE

A. Preconstruction Conference: Schedule a preconstruction conference before starting construction at the project site, at a time convenient to the Owner, Inspector of Record, and the Architect, but no later than 14 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Owner and Architect to conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent shall attend the conference. Major subcontractors and other concerned parties shall be invited to attend the conference, but attendance is not mandatory. 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 could affect progress, including but not limited to the following:

1. Tentative construction schedule.
2. Critical work sequencing and long-lead items.
3. Designation of key personnel and their duties.
4. Lines of communication.
5. Procedures for processing field decisions and Change Orders.
6. Procedures for processing Applications for Payment.

7. Procedures for RFI's.
8. Procedures for testing and inspection.
9. Submittal procedures.
10. Sustainability requirements including construction waste management and disposal.
11. Preparation of record documents.
12. Use of the premises.
13. Work restrictions and working hours.
14. Temporary facilities and controls.
15. Parking availability.
16. Office, work, and storage areas.
17. Equipment deliveries and priorities.
18. Safety procedures and first aid.
19. Security.
20. Housekeeping.
21. Owner's alcohol, drug and tobacco policy.

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Inspector of Record, and Architect, within three days of the meeting.

1.4 PREINSTALLATION CONFERENCES

A. Preinstallation Conferences: Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.

B. Attendees: Installers 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 the Owner, Inspector of Record, and Architect of scheduled meeting dates.

C. Agenda: Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:

1. Contract Documents.
2. Options.
3. Related RFI's, Proposal Requests, and Change Orders.
4. Purchases.
5. Deliveries.
6. Submittals.
7. Sustainability requirements.
8. Possible conflicts.
9. Compatibility problems.
10. Time schedules.
11. Weather limitations.
12. Manufacturer's written instructions.
13. Warranty requirements.
14. Compatibility of materials.
15. Acceptability of substrates.

16. Temporary facilities.
17. Space and access limitations.
18. Regulations of authorities having jurisdiction.
19. Safety.
20. Testing and ionspecting requirements.
21. Required performance results.
22. Recording requirements.
23. Protection.
24. Record significant conference discussions, agreements, disagreements, including corrective measures and actions.
25. Promptly distribute minutes of the meeting to each party present and to other parties requiring information, including the Owner and the Architect.
26. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Inspector of Record, and Architect, within three days of the meeting.

1.5 PROGRESS MEETINGS

A. Progress Meetings: Conduct progress meetings at the Project Site at regular intervals to be established by the Architect, Inspector of Record, Contractor, and Owner.

1. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project. Review proposed percentages of work completed for current months progress payment.

1. 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.

2. Review the present and future needs of each entity present, including the following:

    a. Interface requirements.
    b. Sequence of operation.
    c. Status of submittals.
    d. Status of Sustainability documentation.
    e. Deliveries.
    f. Off-site fabrication.
    g. Access.
    h. Site utilization.
    i. Temporary facilities and services.
    j. Status of correction of deficient items.
    k. Field observations.
    l. Status of RFI's, Proposal Requests, and Change Orders.
    m. Progress cleaning.
    n. Quality and work standards.
    o. Documentation of information for payment requests.
    p. Request for Information

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Inspector of Record, and Architect, within three days of the meeting.

E. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule to the Owner, the Architect, and all other parties involved in the project. Failure to revise and keep current the Contractor's construction schedule may be grounds for returning Application for Payment unreviewed.

1.6 PROJECT CLOSEOUT CONFERENCE

A. Project Closeout Conference: Conduct a project closeout conference, at a time convenient to Owner and Architect, but not less than 90 days prior to the scheduled date of Substantial Completion. Conduct the conference to review requirements and responsibilities related to Project closeout.

B. Attendees: Authorized representatives of Owner, Architect and their consultants; Contractor and its superintendent. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

1. Preparation of record documents.
2. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
3. Submittal of written warranties.
4. Requirements for completing Sustainability documentation.
5. Requirements for preparing operations and maintenance data.

6. Requirements for delivery of material samples, attic stock, and spare parts.
7. Requirements for demonstration and training.
8. Preparation of Contractor's punch list.
9. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
10. Submittal procedures.
11. Responsibility for removing temporary facilities and controls.

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Inspector of Record, and Architect, within three days of the meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013200
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. Contractor's construction schedule.
2. Special reports.

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

1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
2. Division 01 Section "Quality and Testing Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: 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.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. 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.

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

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. 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.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Milestone: An activity, which occurs in an instant and thus has no time duration, a key or critical point in time for reference or measurement.

1.4 SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit electronic copy of schedule labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

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

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

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
1. Discuss constraints, including work stages, interim milestones and multiple contracts..
2. Review delivery dates for Owner-furnished products.
3. Review schedule for work of Owner's separate contracts.
4. Review submittal requirements and procedures.
5. Review time required for review of submittals and resubmittals.
6. Review requirements for tests and inspections by independent testing and inspecting agencies.
7. Review time required for Project closeout and Owner startup procedures, including commissioning activities.

8. Review and finalize list of construction activities to be included in schedule.
9. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules with performance of construction activities and with scheduling of separate contractors.

B. Coordinate Contractor's construction schedule with the submittal schedule and other required schedules.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following 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.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Completion: Indicate completion in advance of date established for completion, and allow time for Architect's administrative procedures necessary for certification of completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:

    a. Limitations of continued occupancies.
    b. Uninterruptible services.
    c. Partial occupancy before Substantial Completion.
    d. Use of premises restrictions.
    e. Provisions for future construction.
    f. Seasonal variations.
    g. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Submittals.
    b. Purchases.
    c. Mockups.
    d. Fabrication.
    e. Sample testing.
    f. Deliveries.
    g. Installation.
    h. Tests and inspections.
    i. Adjusting.
    j. Curing.
    k. Startup and placement into final use and operation.

6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. 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.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

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.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing
    j. Commissioning.
    k. Punch list and final completion.
    l. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.3 SPECIAL REPORTS

A. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At progress meetings, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, Inspector of Record, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 013233
PHOTOGRAPHIC 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 the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.

1.3 SUBMITTALS

A. Digital Photographs: Submit image files at monthly intervals coinciding with the cutoff date associated with each Application for Payment.

1. Submit photos by uploading to Project FTP site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description:

    a. Date photograph was taken.
    b. Description of location, vantage point, and direction.
    c. Unique sequential identifier keyed to accompanying key plan.

3. Key Plan: Include key plan of Project site and/or building(s) indicating location and direction of each photograph or group of photographs. Include same information as corresponding photographic documentation.

1.4 PHOTOGRAPHIC FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. File Names: Name media files with location or area photograph was taken, date, and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

B. Key Plan: Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and adjacent areas, including existing items to remain during construction, from different vantage points, as necessary to record preconstruction conditions.

1. Take additional photographs as needed to record settlement or cracking of existing adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take photographs to record construction progress at not greater than bi-weekly intervals with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300
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. Submittal schedule requirements.
2. Administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
3. Cost for multiple resubmittals.

B. Related Sections:

1. Division 01 Section “Payment Procedures” for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Project Management and Coordination" for submitting coordination drawings.
3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Division 01 Section "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and final completion construction photographs.
5. Division 01 Section "Quality and Testing Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Division 01 Section "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Division 01 Section "Project Record Drawings" for submitting record Drawings.
9. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit as a submittal, a list 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 modifications to submittals noted by the 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 start-up 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.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Name of subcontractor.
    d. Description of the Work covered.
    e. Scheduled date for Architect's final release or approval.
    f. Scheduled dates for purchasing.
    g. Scheduled date of fabrication.
    h. Scheduled dates for installation.
    i. Activity or event number.

1.4 SUBMITTAL FORMAT AND PROCEDURES

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

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.
2. Architect will not review submittals received from sources other than the Contractor.

B. Electronic Digital Submittals: Prepare submittals as PDF package unless otherwise indicated, incorporate complete information into each PDF file, name PDF file with submittal number, and transmit submittal package to Architect via email.

1. Paper Submittals: Where paper submittals are requested, necessary, or required in lieu of electronic submittals, prepare submittals in paper form and deliver to Architect. Transmit each paper submittal using transmittal form. Comply with the following:

    a. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
    b. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
    c. Number of Copies: Submit not less than three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
    d. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form.

C. Submittal Cover Page Information: Include the following information on the submittal cover page for each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
8. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
9. Drawing number and detail references, as appropriate.
10. Indication of full or partial submittal.
11. Location(s) where product is to be installed, as appropriate.
12. Other necessary identification.
13. Remarks.
14. Signature of transmitter.
15. Contractor’s review/approval stamp of size required by contractor, approximately 3 inches by 3 inches, on or beside title block to record Contractor's review and approval.
16. Space for Architect’s review stamp of not less than 4 inches wide by 3-1/2 inches high on or beside title block to record Architect’s review stamp and action taken by Architect.

D. Product Options:

1. Clearly identify options requiring selection by Architect.
2. Clearly identify product options required to comply with the Contract Documents.

E. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

F. Field Conditions: Indicate field conditions where applicable to the work associated with the submittal.

G. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate timing of submitting submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review related submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

H. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 14 calendar 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.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 calendar days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 calendar days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

J. 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.

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

1.5 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. 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.

2. Drawing Sheet Size: Except for templates, patterns, and similar full-size Drawings, prepare Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in PDF format unless otherwise indicated.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Submit samples in PDF format unless physical samples are required.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three (3) sets of Samples. Architect will retain two (2) Sample sets; remainder will be returned.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. 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.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a 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. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. 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.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. 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.

H. Test and Research Reports:

1. 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.
2. 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.
3. 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.
4. Preconstruction 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.
5. 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.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    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.

1.6 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file(s) 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.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.7 CONTRACTOR'S REVIEW

A. Contractor’s Review of Submittals: Contractor shall review each submittal and check for completeness, coordination with other Work of the Contract, and compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include 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.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.
2. Contractor’s approval shall certify the following actions by the Contractor:

a. Field measurements have been determined, verified, and indicated on submittal.
b. Field conditions have been verified and coordinated with Work associated with the submittal.
c. The Work associated with the submittal is in conformance with the Contract Documents.

d. Work being performed by various subcontractors and trades is coordinated with Work associated with the submittal including work being performed by others for the Owner.
e. Deviations from the Contract Documents are identified and notes.

1.8 ARCHITECT'S REVIEW

A. Architect's Review and Action: Architect will review each submittal, indicate corrections or revisions required, mark with an action stamp indicating one of the following actions, and return it.

1. Reviewed: Final unrestricted release, work may proceed, provided it complies with the Contract Documents.
2. Furnish as Corrected: Final but restricted release, work may proceed, provided written confirmation is delivered to Architect by Contractor that installed work complied with notations and corrections on submittal and with Contract Documents.
3. Revise and Resubmit: Returned for resubmittal, do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain an acceptable action marking. Do not allow submittals with this marking (or unmarked submittals where a marking is required) to be used in connection with performance of the Work.
4. Rejected: Submittal content varies from the Contract Documents and is not acceptable for use on the Project, do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain an acceptable action marking. Do not allow submittals with this marking (or unmarked submittals where a marking is required) to be used in connection with performance of the Work.

B. Non-conforming Submittals: The following are considered non-confirming submittals and will not be reviewed by the Architect.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.
2. Architect will not review submittals received from sources other than the Contractor.
3. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
4. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

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

1.9 COST FOR MULTIPLE RESUBMITTALS

A. Contractor's initial submittal and one resubmittal are included in the Architect's Construction Administration services to the Owner. Architect's services for review of subsequent resubmittals will be charged to the Owner at the Architect's current billing rate, and the Owner will deduct the charges from the Contract Amount by a change order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014000
QUALITY AND TESTING 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 including but not limited to the following:

1. General quality requirements.
2. Reports and documents.
3. Contractor’s responsibilities for testing and inspections.
4. Project Inspector.
5. Testing Agency.
6. Governing agency testing and inspection requirements.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

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

C. Related Requirements:

1. Divisions 02 through 33 Sections for specific test and inspection requirements.

D. DSA Testing and Inspection Requirements for School Construction: The following requirements are per the Division of the State Architect (DSA); requirements indicated below may be repeated elsewhere in this Section or in other Sections of the Project Manual, where conflicts occur, the most stringent condition shall apply.

1. Tests:

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

2. Tests Reports: One copy of all test reports shall be forwarded to the Division of the State Architect by the testing agency. Such reports shall include all the tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of Title 24 and with the approved specifications. Test reports shall show the specified design strength. They shall also state defiantly whether or not the material or materials tested comply with requirements.
3. Verification of Test Reports: Each testing agency shall submit to the Division of the State Architect a verified report in duplicate covering all the tests which are required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time, and at the completion of the project, covering all tests.
4. Inspection by the Owner:

   a. The Owner and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
   b. The Owner shall have the right to reject materials and workmanship which are defective, or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the Owner. If the Contractor does no correct such rejected work within a reasonable time, fixed by written notice, the Owner may correct same and charge expense to the Contractor.

c. Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

5. Inspector – Owner's:

a. An Inspector employed by the Owner, and approved by DSA, in accordance with the requirements of the California Code of Regulations, Title 24 will be assigned to the work. His duties are specifically defined in Title 24, Part I, Sec. 4-342.
b. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this contract.

6. Inspector – Owner – Field Office: The Contractor shall provide for the use of the Owner's Inspector a temporary office to be located as directed by the Inspector and to be maintained until removal is authorized by the Owner. This office shall of substantial water proof construction with adequate natural light and ventilation by means of stock design windows. The door shall have a lock. A table satisfactory for the study of plans and two chairs shall be provided by the Contractor. The Contractor shall provide and pay for adequate electric lights, private local telephone service with a loud exterior bell, and adequate heat for this field office until the completion of the Contract.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

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

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and 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.

1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or as indicated in-place portions of permanent construction, consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.

    a. Include each system, assembly, component, and part of the exterior wall and/or roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.

3. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
4. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

I. Source Quality-Control Tests and Inspections: 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 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer 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.

1.6 INFORMATIONAL SUBMITTALS

A. Reports: Prepare and submit certified written reports and documents as specified.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Reports shall be prepared by the person performing the testing and inspecting. Include the following:

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

B. Governing Agency Verified Reports: Complete and submit Verified Reports as required by the Division of the State Architect and the 2022 California Administrative Code, Section 4-240. Reports are required to be completed by Architect, Architect's consulting Engineers, Owner's Project Inspector, Contractor, and Testing Agency.

1. Form:

a. DSA form DSA-6C for Contractor.
b. DSA form DSA-6PI for Project Inspector.
c. DSA form DSA-6A/E for Architect and Architect's consulting Engineers.

C. Manufacturer's Technical Representative's Field Reports: Provide written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Reports shall be prepared by Manufacturer's technical representative performing the testing and inspecting. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

D. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Reports shall be prepared by Factory-authorized service representative performing the testing and inspecting. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.8 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

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

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 licensed to practice in the state where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

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

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a 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.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.

3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings or as specified in individual specification Sections. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.

1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.

1.9 PROJECT INSPECTOR

A. General: Owner will employ a Project Inspector for continuous inspection of the Work. Project Inspector shall be acceptable to Architect and approved by the Division of the State Architect.

1. Project Inspector shall act under the direction of the Architect and shall be subject to supervision by a representative of the Division of the State Architect.

B. Qualifications for Project Inspector: Qualifications for the Project Inspector shall be as stated in the California Code of Regulations, Title 24, Part 1, 2022 California Administrative Code, Section 4-333.1. Project Inspector shall be DSA certified under one of the following classes:

1. Class 1: May inspect any project.
2. Class 2: May inspect any project except a project containing one or more new large structures with a primary lateral load resisting system of steel, masonry, or concrete.

3. Class 3: May inspect projects containing alterations to approved buildings, site placement of relocatable buildings, and construction of minor structures.
4. Class 4: May inspect site placement of relocatable buildings and associated site work.

C. Duties of the Project Inspector: Duties of the Project Inspector shall be as stated in the California Code of Regulations, Title 24, Part 1, 2022 California Administrative Code, Sections 4-333(b) and 4-342, and include the following:

1. Provide continuous inspection of the work.
2. Maintain files and records of approved plans and specifications including addenda and change orders.
3. Prepare semi-monthly reports of the progress of the work and submit copies to the Architect and the Division of the State Architect.
4. Notify the Division of the State Architect at the following times:

    a. At the start of construction of the project or restart of construction if work has suspended for a period of 2 or more weeks.
    b. At least 48 hours in advance of the time when foundation trenches will be complete, ready for footing forms.
    c. At least 48 hours in advance of the first placement of foundation concrete and 24 hours in advance of any subsequent or significant concrete placement.
    d. When all work on the project has been suspended for a period of more than 2 weeks.

5. Prepare and maintain records of certain phases of construction including but not limited to the following:

    a. Concrete placing operations. Show date and time of placing concrete and the time and date of removal of forms in each portion of the structure.
    b. Welding operations. The record shall include identification marks of welders, lists of defective welds, and manner of correction of defects.

6. Notify the Contractor, in writing, of any deviations from the approved construction documents.
7. Prepare and submit Project Inspector’s Verified Report as required by DSA.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to conduct tests and inspections required by authorities having jurisdiction. Testing agency shall be acceptable to Architect and the Division of the State Architect. Requirements for tests and testing agency shall be as stated in the California Code of Regulations, Title 24, Part 1, 2022 California Administrative Code, Section 4-335.

1. Costs for testing agency services will be paid by the Owner.

2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be paid by the Owner and the amount will be deducted from the Contract Sum by Change Order.

B. Contractor Responsibilities: 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.

1. 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.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
7. 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.
    f. Security and protection for samples and for testing and inspecting equipment at Project site.

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

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

9. Schedule of Tests and Inspections: 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 and submit with each Application for Payment.

    a. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
    b. 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.

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

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

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct tests and inspections.
4. Prepare written reports of tests and inspections, state in each report whether tested and inspected Work complies with or deviates from requirements, and submit reports of each test, inspection, and similar quality-control service to Architect, Division of the State Architect, and Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

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

F. 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 preinstallation 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.

1.11 TESTS AND INSPECTIONS

A. Structural Tests and Inspections shall be as specified in Division 02 through 33 Sections for specific materials and as required by form DSA-103 which lists tests and inspections required by DSA as applicable to Project conditions.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and 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. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections 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 Division 01 Section "Execution."

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

SECTION 014200
REFERENCES

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 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract. Architect’s approval does not release the Contractor from the responsibility to fulfill Contract requirements.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.

20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.

62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; www.eciaonline.org.
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
83. FM Approvals - FM Approvals LLC; www.fmglobal.com.
84. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
86. FSA - Fluid Sealing Association; www.fluidsealing.com.
87. FSC - Forest Stewardship Council U.S.; www.fscus.org.
88. GA - Gypsum Association; www.gypsum.org.
89. GANA - Glass Association of North America; www.glasswebsite.com.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
94. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
95. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
96. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
97. IAS - International Accreditation Service; www.iasonline.org.
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; www.iccsafe.org.
101. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
102. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
103. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.

104. IEC - International Electrotechnical Commission; www.iec.ch.
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
109. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
110. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
111. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
116. ISO - International Organization for Standardization; www.iso.org.
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; www.itu.int/home.
119. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; www.lightning.org.
122. MBMA - Metal Building Manufacturers Association; www.mbma.com.
123. MCA - Metal Construction Association; www.metalconstruction.org.
124. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
125. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
126. MHIA - Material Handling Industry of America; www.mhia.org.
127. MIA - Marble Institute of America; www.marble-institute.com.
128. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
129. MPI - Master Painters Institute; www.paintinfo.com.
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
131. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
132. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
133. NADCA - National Air Duct Cleaners Association; www.nadca.com.
134. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
135. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
136. NBI - New Buildings Institute; www.newbuildings.org.
137. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
138. NCMA - National Concrete Masonry Association; www.ncma.org.
139. NEBB - National Environmental Balancing Bureau; www.nebb.org.
140. NECA - National Electrical Contractors Association; www.necanet.org.
141. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
142. NEMA - National Electrical Manufacturers Association; www.nema.org.
143. NETA - InterNational Electrical Testing Association; www.netaworld.org.
144. NFHS - National Federation of State High School Associations; www.nfhs.org.
145. NFPA - National Fire Protection Association; www.nfpa.org.

146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; www.nfrc.org.
148. NHLA - National Hardwood Lumber Association; www.nhla.com.
149. NLGA - National Lumber Grades Authority; www.nlga.org.
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
152. NRCA - National Roofing Contractors Association; www.nrca.net.
153. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
154. NSF - NSF International; www.nsf.org.
155. NSPE - National Society of Professional Engineers; www.nspe.org.
156. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
158. NWFA - National Wood Flooring Association; www.nwfa.org.
159. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
160. PDI - Plumbing & Drainage Institute; www.pdionline.org.
161. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
162. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
163. RFCI - Resilient Floor Covering Institute; www.rfci.com.
164. RIS - Redwood Inspection Service; www.redwoodinspection.com.
165. SAE - SAE International; www.sae.org.
166. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
167. SDI - Steel Deck Institute; www.sdi.org.
168. SDI - Steel Door Institute; www.steeldoor.org.
169. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
170. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
171. SIA - Security Industry Association; www.siaonline.org.
172. SJI - Steel Joist Institute; www.steeljoist.org.
173. SMA - Screen Manufacturers Association; www.smainfo.org.
174. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
175. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
176. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
177. SPIB - Southern Pine Inspection Bureau; www.spib.org.
178. SPRI - Single Ply Roofing Industry; www.spri.org.
179. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
180. SSINA - Specialty Steel Industry of North America; www.ssina.com.
181. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
182. STI - Steel Tank Institute; www.steeltank.com.
183. SWI - Steel Window Institute; www.steelwindows.com.
184. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
185. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
186. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.

189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
190. TMS - The Masonry Society; www.masonrysociety.org.
191. TPI - Truss Plate Institute; www.tpinst.org.
192. TPI - Turfgrass Producers International; www.turfgrasssod.org.
193. TRI - Tile Roofing Institute; www.tileroofing.org.
194. UL - Underwriters Laboratories Inc.; www.ul.com.
195. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
196. USAV - USA Volleyball; www.usavolleyball.org.
197. USGBC - U.S. Green Building Council; www.usgbc.org.
198. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
199. WASTEC - Waste Equipment Technology Association; www.wastec.org.
200. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
201. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
202. WDMA - Window & Door Manufacturers Association; www.wdma.com.
203. WI - Woodwork Institute; www.wicnet.org.
204. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
205. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.

14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000
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.

B. Related Requirements:

1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
2. Division 01 Section "Multiple Contract Summary" for responsibilities for temporary facilities and controls for projects utilizing multiple contracts.
3. Division 01 Section “Fire Safety During Construction” for fire safety requirements during construction.
4. Division 31 Sections applicable to site clearing, earthwork, and trenching for temporary erosion and sedimentation control.

1.3 USE CHARGES

A. General: Installation, removal, 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, Architect, testing agencies, and authorities having jurisdiction.

B. Water Service from Existing System: Water from Owner's existing water system is available for use; provide connections and extensions of services as required for construction operations.

1. Water service is available for use without metering and without payment of use charges.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use; provide connections and extensions of services as required for construction operations.

1. Electric power service is available for use without metering and without payment of use charges.

1.4 SUBMITTALS

A. Erosion and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Comply with submittal requirements of Division 31 through 33 Sections as applicable for temporary erosion and sedimentation control plans.

1.5 QUALITY ASSURANCE

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

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

1.6 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. California Code of Regulations, Title 24, California Code requirements as applicable to the project.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.
6. Regional Air Pollution Control District permits and requirements.
7. California Department of Water Resources, Stormwater General Permit for projects with site work area greater than one acre.
8. Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1.7 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.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Materials for temporary facilities shall be acceptable to Architect, Owner, and Authorities having Jurisdiction (AHJ), shall be appropriate for intended use, and shall comply with governing codes and regulations.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts. Provide concrete or galvanized-steel bases for supporting posts.

C. Fencing Windscreen: Polyester fabric scrim with grommets for attachment to chain link fence, size and color as acceptable to, or required by, authorities having jurisdiction.

2.2 TEMPORARY FIELD OFFICE FACILITIES

A. Field Offices, General: Prefabricated or mobile units having weatherproof exteriors, lockable doors and windows, and with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Contractor's Field Office: Of sufficient size to accommodate needs of Contractor, Owner, Architect, 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 necessary for use and storage of Project documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room or area of sufficient size to accommodate meetings of 10 individuals; furnish with conference table, chairs, and 4-foot square tack and marker boards.
3. Electrical power service, 120-VAC, with no fewer than one duplex receptacle on each wall.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 78 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
6. Communication Service and Equipment: Equip field office with phone and internet services and equipment adequate for project conditions and for use by Contractor, Architect, and Owner to access Project electronic documents and maintain electronic communications.

    a. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
    b. Equip office with not less than the following:

        1) Desktop computer with capabilities compatible with Architect's requirements. Provide external hard drive backup.

2) Printer/Copier/Scanner: Single or multiple units as needed to accommodate color printing, photocopying, and scanning.

C. Project Inspector's Field Office: Contractor shall provide temporary office facilities for the Owner's Project Inspector. Temporary facilities shall be of sufficient size to accommodate the needs of the Project Inspector and associated project records. Project Inspector facilities shall be provided with its own lockable exterior access, if interconnected with Contractor's facilities, a lockable door, controlled from the Project Inspector's side, shall be provided between the spaces. Furnish and equip office as follows:

1. Plan/layout table, 30 by 72 inches minimum.
2. File cabinets having a total capacity of not less than eight (8) legal size file drawers.
3. Open shelving/book case, 48 inches minimum in total shelving width.
4. Desk and Chair.
5. Plan rack.
6. Internet service.
7. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 78 deg F.
8. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 TEMPORARY STORAGE FACILITIES

A. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from buildings.

2.4 TEMPORARY SANITARY FACILITIES

A. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use by construction and related administrative personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Temporary toilets shall be self-contained, single-occupant units of the chemical, aerated recirculation type; provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Use of Owner's sanitary facilities is not permitted.

1. Accessible Sanitary Facilities: Sanitary facilities serving support facilities such as offices, meeting rooms, plan rooms, and serving personnel not directly associated with the actual processes of construction shall be accessible for a person using a wheelchair and shall comply with CBC Section 11B-213 (Ref. CBC 11B-201.4).

2.5 EQUIPMENT

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

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

- Type 2A-10B:C as noted

- Class K per CFC 906.4

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. 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.
3. 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 and clean HVAC system as required in Division 01 Section "Closeout Procedures."

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

A. Locate facilities at locations directed by the Owner where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

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 UTILITIES AND BUILDING HVAC

A. General: Install temporary service or connect to existing service.

1. 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: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to private or municipal system as indicated on Drawings and as directed by authorities having jurisdiction.

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

1. Existing Water Service: Where connection to Owner’s existing water service is available and allowed, clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. 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.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

E. Ventilation and Humidity Control: 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.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Where temporary power service is required, install electric power service overhead unless otherwise indicated.
2. Where Owner’s existing power service is available, connect temporary service to Owner's existing power source, as directed by Owner, maintain equipment in a condition acceptable to Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Telephone Service: Provide temporary telephone service of sufficient size, capacity, and power characteristics required for construction operations in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment for each field office.

1. Post a list of important telephone numbers at a conspicuous location, include the following:

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Locate storage containers, and other temporary construction and support facilities for easy access in the areas designated and approved by the Architect and Owner. Comply with the following:

1. Do not locate temporary offices, shops, and sheds within 30 feet of building lines.
2. 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. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Parking areas for construction personnel shall be at location(s) as directed by Owner.

D. Dewatering: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Project Address Sign: Provide temporary project address sign as required by Authority having Jurisdiction.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations.

1. Comply with requirements of the following:

    a. Authorities having jurisdiction.
    b. Division 01 Section "Execution" for progress cleaning.
    c. Division 01 Section "Construction Waste Management and Disposal."

2. Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: 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.

B. Environmental Protection: 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.

1. Comply with work restrictions specified in Division 01 Section "Summary."

C. Temporary Erosion and Sedimentation Control: 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 erosion and sedimentation-control Drawings, EPA Construction General Permit, or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree or plant- protection zones.

2. Inspect, repair, and maintain erosion and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: 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: 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: Engage pest-control service 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. Security Enclosure Fence and Lockup: Before construction operations begin, furnish and install project enclosure fence in a manner that will prevent people and animals from easily entering the site except by entrance gates. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

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

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

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

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Fire Protection: 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.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. 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.

3.6 MOISTURE AND MOLD CONTROL

A. General: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: 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:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. 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 Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. 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 48hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: 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: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for 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.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

3.8 TEMPORARY FACILITIES RESPONSIBILITY MATRIX

	Temporary Facility	Modular Building	Site Work	Shade Structure		Comments
1.	Temporary Field Office Facilities		X			
2.	Temporary Storage Facilities	X	X	X		As applicable to the work of each contractor for its own work.
3.	Temporary Sanitary Facilities		X			Provided by Site Work Contractor, available for use by all contractors.
4.	Equipment	X	X	X		As applicable to the work of each contractor for its own work.
5.	Water Service		X			Provided by Site Work Contractor, available for use by all contractors.
6.	Electric Power Service		X			Provided by Site Work Contractor, available for use by all contractors.
7.	Telephone Service	X	X	X		As applicable to the work of each contractor for its own work.
8.	Dewatering, Temporary Erosion and Sedimentation Control and Storm Water Control.		X			
9.	Project Signs		X			
10.	Waste Disposal Facilities	X	X	X		As applicable to the work of each contractor for its own work. See Division 01 Section “Construction Waste Management and Disposal.”
11.	Lifts and Hoists	X	X	X		As applicable to the work of each contractor for its own work.
12.	Tree and Plant Protection		X			
13.	Pest Control		X			
14.	Security Enclosure Fence and Lockup		X			
15.	Fire Safety	X	X			As applicable to the work of each contractor for its own work.

END OF SECTION

SECTION 015116
FIRE SAFETY DURING CONSTRUCTION

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 fire safety during construction and demolition.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for additional facilities, requirements, and procedures required during construction.

1.3 SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.4 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions of the following:

1. NFPA 241.
2. California Fire Code, 2022 Edition, Chapter 33 “Fire Safety During Construction and Demolition” and the 2022 Editions of the following California Codes as Referenced by the California Fire Code:

a. California Building Code (CBC).
b. California Mechanical Code (CMC).
c. California Plumbing Code (CPC).
d. California Electrical Code (CEC).

B. Temporary Heating Equipment (CFC 3303):

1. General: Temporary heating devices shall be listed and labeled in accordance with the California Mechanical Code. Installation, maintenance and use of temporary heating devices shall be in accordance with the terms of the listing.

2. LP-Gas heaters: Heating devices shall be temporary, self-contained, liquid-propane-gas heaters with individual space thermostatic control. Fuel supplies for liquefied petroleum gas fired heaters shall comply with the California Fire Code, Chapter 61 Liquefied Petroleum Gases, and the California Mechanical Code.
3. Refueling: Refueling operations for liquid fueled equipment or appliances shall be conducted in accordance with the California Fire Code, Section 5705. The equipment or appliance shall be allowed to cool prior to refueling.
4. Installation: Clearance to combustibles from temporary heating devices shall be maintained in accordance with the labeled equipment. When in operation, temporary heating devices shall be fixed in place and protected from damage, dislodgement or overturning in accordance with the manufacturer's instructions.
5. Supervision: The use of temporary heating devices shall be supervised and maintained only by competent personnel.
6. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

C. Precautions Against Fire (CFC 3304):

1. Smoking: Smoking shall not be allowed on the project site.
2. Combustible Debris, Rubbish and Waste:

    a. Combustible debris, rubbish and waste shall not be accumulated within buildings.
    b. Combustible debris, rubbish and waste material shall be removed from buildings at the end of each shift of work.
    c. Rubbish containers with a capacity exceeding 5.33 cubic feet (40 gallons) used for temporary storage of combustible debris, rubbish and waste materials, shall have tight fitting or self-closing lids. Such containers shall be constructed entirely of materials that are non-combustible or materials that meet a peak rate of heat release not exceeding 300 kW/m^2 when tested in accordance with ASTM E 1354 at an incident heat flux of 50 kW/m^2 in the horizontal orientation.
    d. Materials susceptible to spontaneous ignition, such as oily rags, shall be stored in a listed disposal container.

3. Burning: Burning of materials shall not be allowed on the project site.
4. Fire Watch: Where required by the fire code official, a fire watch shall be provided for building demolition and for building construction during working hours that is hazardous in nature, such as temporary heating or hot work.

    a. Trained personnel shall be provided to serve as an on-site fire watch. Fire watch personnel shall be provided with not less than one approved means for notification of the fire department, and the sole duty of such personnel shall be to perform constant patrols and watch for the occurrence of fire. The combination of fire watch duties and site security is acceptable. Fire watch personnel shall be trained in the use of portable fire extinguishers.
    b. The fire watch personnel shall keep a record of all time periods of duty, including a log entry each time the site was patrolled, and each time a structure under construction was entered and inspected. The records and log entries shall be made available for review by the fire code official upon request.

5. Cutting and Welding: Welding, cutting, open torches, and other hot work operations and equipment shall comply with California Fire Code, Chapter 35 “Welding and Other Hot Work.’
6. Temporary Wiring for Electrical Power: Temporary wiring for electrical power and lighting installations used in connection with the construction, alteration or demolition of buildings, structures, equipment or similar activities shall comply with the California Electrical Code.

D. Flammable and Combustible Liquids (CFC 3305):

1. Storage of Flammable and Combustible Liquids: Storage of flammable and combustible liquids shall be in accordance with the California Fire Code, Section 5704.
2. Class I and Class II Liquids: Storage, use, and handling of flammable and combustible liquids at construction sites shall be in accordance with the California Fire Code, Section 5706.2. Ventilation shall be provided for operations involving the application of materials containing flammable solvents.
3. Housekeeping: Flammable and combustible liquid storage areas shall be maintained clear of combustible vegetation and waste materials. Such storage areas shall not be used for the storage of combustible materials.
4. Precautions Against Fire: Sources of ignition and smoking shall be prohibited in flammable and combustible liquid storage areas. Signs shall be posted in accordance the California Fire Code, Section 310.
5. Handling at Point of Final Use: Class I and Class II liquids shall be kept in approved safety containers.
6. Leakage and Spills: Leaking vessels shall be immediately repaired or taken out of service and spills shall be cleaned up and disposed of properly.

E. Flammable Gases (CFC 3306):

1. Storage and Handling: Storage and handling of flammable gasses shall comply with the California Fire Code, Chapter 58 “Flammable Gases and Flammable Cryogenic Fluids.”
2. Cleaning with Flammable Gases: Flammable gases shall not be used to clean or remove debris from piping open to the atmosphere.

F. Explosive Materials (CFC 3307): Explosive materials shall not be allowed.

G. Owner’s Responsibility for Fire Protection (CFC 3308)

1. Program Development: The Contractor shall be responsible for the development, implementation and maintenance of a written plan establishing a fire prevention program at the project site applicable throughout all phases of the construction.
2. Program Superintendent: The Contractor shall a person to be the Fire Prevention Program Superintendent who shall be responsible for the fire prevention program and ensure that it is carried out through completion of the project. The fire prevention program superintendent shall have the authority to enforce the provisions of the California Fire Code, Chapter 33, and other provisions as necessary to secure the intent of the California Fire Code, Chapter 33. Where guard service is provided in accordance with NFPA 241, the superintendent shall be responsible for the guard service.

3. Prefire Plans: The fire prevention program superintendent shall develop and maintain an approved prefire plan in cooperation with the fire chief. The fire chief and the fire code official shall be notified of changes affecting the utilization of information contained in such prefire plans.
4. Training: Training of responsible personnel in the use of fire protection equipment shall be the responsibility of the fire prevention program superintendent. Records of training shall be kept and made a part of the written plan for the fire prevention program.
5. Fire Protection Devices: The fire prevention program superintendent shall determine that all fire protection equipment is maintained and serviced in accordance with the California Fire Code. The quantity and type of fire protection equipment shall be approved. Fire protection equipment shall be inspected in accordance with the fire prevention program.
6. Hot Work Operations: The fire prevention program superintendent shall be responsible for supervising the permit system for hot work operations in accordance with the California Fire Code, Chapter 35.
7. Impairment of Fire Protection Systems: Impairments to any fire protection system shall be in accordance with the California Fire Code, Section 901.

    a. Smoke detectors and smoke alarms located in an area where airborne construction dust is expected shall be covered to prevent exposure to dust or shall be temporarily removed. smoke detectors and alarms that were removed shall be replaced upon conclusion of dust producing work. Smoke detectors and smoke alarms that were covered shall be inspected and cleaned, as necessary, upon conclusion of dust producing work.

8. Temporary Covering of Fire Protection Devices: Temporary coverings placed on or over fire protection devices to protect them from damage during construction processes shall be immediately removed upon the completion of the construction processes in the room or area in which the devices are installed.

H. Fire Reporting (CFC 3309)

1. Emergency Telephone: Emergency telephone facilities with ready access shall be provided in an approved location at the construction site, or an approved equivalent means of communication shall be provided. The street address of the construction site and the emergency telephone number of the fire department shall be posted adjacent to the telephone. Alternatively, where an equivalent means of communication has been approved, the site address and fire department emergency telephone number shall be posted at the main entrance to the site, in guard shacks, and in the construction site office.

I. Access for Fire Fighting (CFC 3310):

1. Required Access: Approved vehicle access for firefighting shall be provided to all construction or demolition sites. Vehicle access shall be provided to within 100 feet of temporary or permanent fire department connections. Vehicle access shall be provided by either temporary or permanent roads capable of supporting vehicle loading under all weather conditions. Vehicle access shall be maintained until permanent fire apparatus access roads are available.

2. Key Boxes: Key boxes shall be provided as required by the California Fire Code, Chapter 5 “Fire Service Features.”

J. Means of Egress (CFC 3311):

1. Stairways Required: (Requirements not applicable to buildings less than 50 feet in height or less than four stories).
2. Means of Egress: Required means of egress and required accessible means of egress shall be maintained during construction and demolition, remodeling or alterations and additions to any building unless an approved temporary means of egress system is provided.

K. Water Supply for Fire Protection (CFC 3312):

1. Water Supply for Fire Protection: An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material arrives on site.

L. Portable Fire Extinguishers (CFC 3315):

1. Portable Fire Extinguishers: Structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher in accordance with the California Fire Code, Section 906 and sized for not less than ordinary hazard, as follows:

    a. At each stairway on all floor levels where combustible materials have accumulated.
    b. In every storage and construction shed.
    c. Additional portable fire extinguishers shall be provided where special hazards exist including, but not limited to, the storage and use of flammable and combustible liquids.

M. Motorized Construction Equipment (CFC 3316):

1. Conditions of Use: Internal combustion powered construction equipment shall be used in accordance with all of the following conditions:

    a. Equipment shall be located so that exhausts do not discharge against combustible material.
    b. Exhausts shall be piped to the outside of the building.
    c. Equipment shall not be refueled while in operation.
    d. Fuel for equipment shall be stored in approved areas outside of the building.

N. Safeguarding Roofing Operations (CFC 3317):

1. General: Roofing operations utilizing heat producing systems or other ignition sources shall be conducted in accordance with California Fire Code Sections 3317.2 and 3317.3, and Chapter 35.
2. Asphalt and Tar Kettles: Asphalt and tar kettles shall be operated in accordance with the California Fire Code, Section 303.

3. Fire Extinguishers for Roofing Operations: Fire extinguishers shall comply with the California Fire Code, Section 906. There shall be not less than one multi-purpose portable fire extinguisher with a minimum 3-A 40-B:C rating on the roof being covered or repaired.

PART 2 - PRODUCTS

2.1 TEMPORARY EQUIPMENT, GENERAL

A. Temporary Equipment: Temporary equipment shall comply with requirements of Division 01 Section “Temporary Facilities and Controls,” and shall comply with the requirements of this Section.

PART 3 - EXECUTION

A. Fire Safety Observation, Procedures, and Features: Provide fire safety observation activities, procedures, and features as required and in compliance with regulatory requirements.

END OF SECTION

SECTION 016000
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 for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Division 01 Section "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

A. Products: 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," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, which is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Products: Products of a listed manufacturer that are demonstrated to meet or exceed the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified ‘Basis of Design’ product.

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

1.4 SUBMITTALS

A. Product Submittals: Comply with requirements in Division 01 Section "Submittal Procedures" and submittal requirements of Division 02 through 33 Sections to show compliance with product requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to 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 products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Warranty Submittals: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Limited List of 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 unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

2. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

    a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

3. Limited List of 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 unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

4. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

    a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

5. Basis of Design Products: Where Specifications include the phrase “Basis of Design” and lists a named manufacturer and product, provide the product indicated.

    a. Where a “Basis of Design” manufacturer/product is followed by “Subject to compliance with requirements, provide product indicated or a comparable product by one of the following,” and includes a list of manufacturers, a comparable product by one of the listed manufacturers may be provided in lieu of the basis of design manufacturer/product subject to compliance with product requirements and the following:

        1) Evidence that the proposed product:

            a) Does not require revisions to the Contract Documents.
            b) Is consistent with the Contract Documents and will produce the indicated results.
            c) Is compatible with other portions of the Work.

        2) 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.
        3) Evidence that proposed product provides specified warranty.

    b. Where a “Basis of Design” manufacturer/product is followed by “Provide specified product or submit request for substitution,” comply with requirements in Division 01 Section "Substitution Procedures" for consideration of an unnamed manufacturer or product.

C. Visual Matching Specification: 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.

    1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300
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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting, patching and repairing.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Protection of existing construction.
8. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "Summary of Work" for limits on use of Project site.

1.3 DEFINITIONS

A. Accessible Route: A continuous unobstructed path connecting accessible elements and spaces of an accessible site, building or facility that can be negotiated by a person with a disability using a wheelchair, and that is also safe for and usable by persons with other disabilities. Interior accessible routes may include corridors, hallways, floors, ramps, elevators and lifts. Exterior accessible routes may include accessible parking stalls and access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps and lifts.

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

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

1.4 QUALITY ASSURANCE

A. Surveyor Qualifications: A professional engineer or land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

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

1. Structural Elements: When cutting of structural elements must be performed, 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.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

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.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Sprayed fire-resistive material.
d. Equipment supports.
e. Piping, ductwork, vessels, and equipment.

4. Visual Elements: Cut and patch construction in a manner that results in no visual evidence of cutting and patching. Do not cut and patch exposed construction 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.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in Division 02 trough 33 Sections.

B. In-Place Materials: 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.

1. 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: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. 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.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for plumbing, mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.

2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is 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.

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. Verify service space requirements for equipment and operating items.

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 Division 01 Section "Request for Information."

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. General: Engage a land surveyor 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 needed to locate each element of Project.
2. Establish limits on use of Project 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 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. Reference Points: 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.

1. 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.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
3. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
4. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. General: 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 in occupied spaces and 90 inches 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 that will ensure 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 on site 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: 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.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. 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.

K. Repair or remove and replace damaged, defective, or nonconforming Work.

3.6 CUTTING, PATCHING, AND REPAIRING

A. General: Employ skilled workers to perform cutting, patching, and/or repairing. Proceed with cutting, patching, and repairing at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. 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.

C. Temporary Support: Provide temporary support of work to be cut.

D. 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.

E. 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 Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

H. Patching and Repairing: Patch and repair construction by grinding, filling, leveling, refinishing, closing up, and similar operations following performance of other work. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched and repaired areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
    b. Where finishes have been removed, patch and repair substrates to receive new finishes; substrates shall be prepared to comply with requirements of manufacturer of final finish material.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project 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 days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. 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 on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

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 requirements in Division 01 Section "General Commissioning 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 Division 01 Section "Quality Requirements."

3.9 PROTECTION AND REPAIR

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

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Comply with manufacturer's written instructions for temperature and relative humidity following installation.

D. Protection of Existing Items: Provide protection and ensure that existing items to remain are undisturbed by construction are maintained in condition that existed at commencement of the Work.

END OF SECTION

SECTION 017419
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 construction waste.
2. Recycling nonhazardous construction waste.
3. Disposing of nonhazardous 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. Disposal: Removal off-site of and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: Recovery of construction waste for subsequent processing in preparation for reuse.

1.4 MATERIALS OWNERSHIP

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

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit Waste Management Plan within 30 days of date established for the Notice to Proceed indicating method of compliance with the California Green Building Standards Code.

1.6 2

INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. 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.

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

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

E. 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.

F. 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.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employee assigned by the General Contractor, with a record of successful waste management coordination of projects with similar requirements. Individual of firm, or Contractor’s employee, shall be a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.

B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.

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

1.8 WASTE MANAGEMENT PLAN/REGULATORY REQUIREMENTS

A. Construction Waste Management, General: Recycle and/or salvage for reuse a minimum of 65 percent of the non-hazardous construction waste in accordance with one of the following 2022 California Green Standards Code (GBSC) Sections, or meet a local construction waste management ordinance, whichever is more stringent:

1. Construction Waste Management Plan (GBSC Section 5.408.1.1): Where a local jurisdiction does not have a construction waste management ordinance that is more stringent, provide Waste Management Plan that:

   a. Identifies the construction waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.
   b. Determines if construction waste materials will be sorted on-site (source separated) or bulk mixed (single stream).
   c. Identifies diversion facilities where construction waste material collected will be taken.
   d. Specifies the amount of construction waste materials diverted shall be calculated by weight or volume, but not by both.

2. Waste Management Company (GBSC Section 5.408.1.2): Utilize a waste management company that can provide verifiable documentation that the percentage of construction waste material diverted from the landfill complies with CGBSC Section 5.408.1.

   a. Exception 1: Excavated soil and land-clearing debris.
   b. Exception 2: Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.
   c. Demolition waste meeting local ordinance or calculated in consideration of local recycling facilities and markets.

3. Waste Stream Reduction Alternative (GBSC Section 5.408.1.3): The combined weight of new construction disposal that does not exceed two pounds per square foot of building area may be deemed to meet the 65 percent minimum requirement as approved by the enforcing agency.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management procedures. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management procedures during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Division 01 Section "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: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management procedures to everyone concerned within three days of submittal return.
2. Distribute waste management procedures to entities when they first begin work on-site. Review procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: Refer to local county websites for the county in which the Project is located for listings of available recycling receivers and processors, and materials accepted.

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

D. 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.

E. Procedures: 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.

1. 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.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Wood Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Closeout procedures at completion.
2. Final cleaning.
3. Repair of the Work.

B. Related Requirements:

1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance documentation requirements.
2. Division 01 Section "Project Record Drawings" for preparing and submitting Project Record Drawings.
3. Division 01 Section "Warranties" for submitting final warranty information.
4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
5. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Submit the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout documentation specified in other Division 01 Sections, including project record drawings, operation and maintenance data, construction photographic documentation, warranties, and similar final record information.
3. Submit closeout documentation specified in individual Division 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance materials specified in individual Division 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
5. Submit test/adjust/balance records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Advise Owner of changeover in utilities.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection for Completion a minimum of 10 days prior to date the work will be completed and ready for inspection. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected.

1. Architect’s Punch List: During inspection, Architect will prepare a list of items needing completion or correction (punch list), a copy of the punch list will be distributed to the Contractor and Owner.
2. Reinspection: Request reinspection when the Work identified in previous inspection as incomplete is completed or corrected.
3. Results of completed inspection will form the basis of requirements for final completion.

E. Contractor's Cost for Reinspection: Architect will perform one inspection and one reinspection at no additional cost to the Contractor. The expense for the Architect's time for additional inspections will be paid by the Owner with the amount being deducted from the Contract Sum. The expense will be based on an hourly rate in accordance with the Architect's standard hourly rate schedule in effect at the time the work is performed with a minimum of $400.00 dollars for each additional reinspection.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect (Company name).
    d. Name of Contractor (Company Name).
    e. Page number.

4. Submit list of incomplete items in one of the following formats:

    a. MS Excel electronic file. Architect will return annotated file.
    b. PDF electronic file. Architect will return annotated file.

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Use cleaning products that comply with the California Green Building Standards Code maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical, electrical, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

1. Comply with requirements of Division 02 through 33 Sections as applicable to the Work to be restored and/or repaired.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 017823
OPERATION AND MAINTENANCE DATA

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 preparing operation and maintenance documentation, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Sections:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Demonstration and Training" for demonstration and training materials.
3. Division 01 Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 SUBMITTALS

A. Closeout Submittal: Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as previously reviewed and approved at the time of individual Section submittals; where applicable, clarify and update previously reviewed content to correspond to revisions and field conditions. Submit reviewed manual content formatted and organized as required by this Section.

1. Initial Submittal: Submit draft electronic copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether content of operations and maintenance submittal is acceptable.

    a. Correct or revise each manual to comply with Architect's comments. Submit final submittal copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

2. Final Submittal: Submit in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Submit the following:

    a. Paper Copy: Submit one paper-copy set of marked-up record prints that have been revised to address Architect’s comments from the initial submittal.
    b. Digital Data Files: Submit digital data files of Project Record Drawings as PDF files on a thumb-drive.

B. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Electronic File Manuals: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Paper Copy Manuals: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number(s) on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials and in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information as applicable:

1. Subject matter included in the manual.
2. Name and address of Project.

3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for the following:

    a. Contractor.
    b. Installer.
    c. Architect.
    d. Commissioning Authority if applicable.
    e. Architect's major consultants that designed the systems contained in the manuals.

6. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identify by product name and arrange to match table of contents. For each piece of equipment, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in data identified by product name and arranged to match table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017836
WARRANTIES

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 warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

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

1. Division 01 Section "Closeout Procedures."
2. Division 01 Section "Operation and Maintenance Data."
3. Division 02 through 33 Sections for specific warranty requirements.

1.3 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special project warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

B. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

E. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

F. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranties: Submit (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
2. Include copy of each warranty in operation and maintenance documentation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017839
PROJECT RECORD DRAWINGS

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 Project Record Drawings:

B. Related Sections:

1. Division 01 Section "Use of Architect's Electronic Files" for requirements related to use of Architect's digital data files.
2. Division 01 Section "Execution" for surveys of exterior accessible routes.
3. Division 01 Section "Closeout Procedures" for general closeout procedures.
4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 RECORD DRAWING SUBMITTAL

A. Closeout Submittal: Submit Record Drawings as follows:

1. Initial Submittal: Submit one paper-copy set of marked-up record prints.

    a. Architect will indicate whether record prints are acceptable or if additional information or documentation is needed and will return the set to the Contractor.

2. Final Submittal:

    a. Paper Copy: Submit one paper-copy set of marked-up record prints that have been revised to address Architect's comments from the initial submittal.
    b. Digital Data Files: Submit digital data files of Project Record Drawings as PDF files on a thumb-drive.

1.4 PROJECT RECORD DRAWINGS

A. Record Drawings: Maintain one set of paper copies of the Contract Drawings during the construction period for Project Record Drawing Purposes.

1. Project Record Drawing print sets shall include all drawings of the Contract Documents including original project Drawings, Shop Drawings, Supplemental Drawings, Coordination Drawings, Clarification Drawings, Change Orders, and similar drawings. Record Drawing set shall include all drawings of Contract Documents whether or not changes and additional information were recorded.
2. Store Project Record Drawings in the field office apart from the Contract Documents used for construction; do not use Project Record Drawings for construction purposes.
3. Maintain Record Drawings in good order and in a clean, dry, legible condition, protected from deterioration and loss.
4. Provide access to Project Record Drawings for Architect's reference during normal working hours.
5. Incorporate new and revised drawings into Project Record Drawings as modifications are issued; do not wait until the end of Project.
6. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

7. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

8. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
9. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
10. Mark important additional information that was either shown schematically or omitted from original Drawings.
11. Note Construction Change Directive numbers, Change Order numbers, and similar identification, where applicable.

B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, submit marked-up record prints to Architect, following Architect's review and action, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings in PDF format for use in recording information.

    a. Refer to Division 01 Section 011105 "Use of Architect's Electronic Files" for requirements related to use of Architect's digital data files.

D. Format:

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files:

    a. Format: Annotated PDF electronic file.
    b. Organize digital data information into separate electronic files corresponding with each building design discipline of the Contract Documents; name each file with the corresponding design discipline.

E. Identification: Include the following information on each Record Drawing:

1. "PROJECT RECORD DRAWING" designation located in a prominent location.
2. Project name if Project name is not included in a title block as part of the drawing.
3. Date.
4. Name of Architect if Architect's name is not included in a title block as part of the drawing.
5. Name of Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel in demonstration and training of operation and maintenance of systems, subsystems, and equipment.

B. Related Sections:

1. Division 01 Section “Operation and Maintenance Data” for operation and maintenance manuals and data.
2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Training materials in addition to Operation and Maintenance manuals required in Division 01 Section “Operation and Maintenance Data.”

B. Instruction Program Schedule: Submit outline schedule of instructional program that includes and coordinates programs for all products, equipment, and systems requiring demonstration and training. Schedule shall include a list of training sessions, proposed dates, times, length of instruction time.

1. Schedule shall be coordinated and finalized with the Owner.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training of Owner’s personnel.

1.5 COORDINATION

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

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

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

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Provide instruction programs that include training sessions for each system and for equipment not part of a system, as required by individual Specification Sections. Include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Operating standards.
    c. Regulatory requirements.
    d. Equipment function.
    e. Operating characteristics.
    f. Limiting conditions.
    g. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction and training. Assemble training manuals organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Coordinate with Owner for number of instruction times, location, and number of participants.

C. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule initial training with Owner**,** through Architect with at least 7 days' advance notice.

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

END OF SECTION

SECTION 018113
SUSTAINABLE DESIGN REQUIREMENTS, DSA CALGREEN

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 general requirements and procedures for compliance with the 2022 California Green Building Standards Code (CGBSC) for Division of the State Architect (DSA) requirements.

B. Related Sections:

1. Project Manual Appendix No. 2, DSA Project Submittal Guideline GL-4.

1.3 SUBMITTALS

A. Submit Sustainable Design Requirement submittals as required by Division 02 through 33 Specification Sections. Submittals may include, but are not limited to, the following:

1. Construction Waste Management Plan and other submittals as required by Division 01 Section "Construction Waste Management and Disposal."
2. Air Quality: Product data for filtration media.
3. Product data for adhesives, sealants, and coatings indicating VOC content of each product used.
4. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.4 REGULATORY REQUIREMENTS

A. DSA's "Project Submittal Guideline: CalGreen Code," form GL-4 (https://www.dgs.ca.gov/-/media/Divisions/DSA/Publications/guidelines/GL_4.pdf?la=en&hash=056C301E3592D09DC9C59DA146D04216AF108A9D). Contractor's responsibility with regard to sustainable design requirements shall include, but not be limited, to the following requirements of the 2022 California Green Building Standards Code).

B. Outdoor Lighting: Outdoor lighting shall be designed and installed to comply with requirements of the 2022 CGBSC, Section 5.106.8.

C. Energy Efficiency: Comply with requirements of the California Energy Code and as indicated on the Drawings.

D. Plumbing Fixtures: Plumbing Fixtures shall comply with requirements of the 2022 CGBSC, Section 5.303.3.

E. Moisture Control: Irrigation systems shall be designed and installed to prevent spray on buildings; per requirements of the 2022 CGBSC, Section 5.407.2.1.

F. Construction Waste Management: Comply with requirements of the 2022 CGBSC, Section 5.408.1 and Division 01 Section “Construction Waste Management and Disposal.” Construction Waste Management shall include, but not be limited to, the following:

1. Construction Waste Management Plan.
2. Recycling, reuse, and/or salvaging non-hazardous construction waste.

G. Environmental Quality/Pollutant Control: Comply with requirements of the 2022 CGBSC, Sections as follows:

1. Section 5.504.3, Covering of Duct Openings and Protection of Mechanical equipment. At the time of rough installation and during storage on the construction site until final startup of the heating, cooling and ventilating equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal or other methods acceptable to the enforcing agency to reduce the amount of dust, water and debris which may enter the system.
2. Section 5.504.4.1, Adhesives and Sealants: Adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

    a. Adhesives: 2022 CGBSC Table 5.504.4.1 Adhesive VOC Limit:

        1) Indoor Carpet Adhesives: 50 g/L.
        2) Carpet Pad Adhesives: 50 g/L.
        3) Rubber Floor Adhesives: 60 g/L.
        4) Wood Flooring Adhesive: 100 g/L.
        5) Subfloor Adhesives: 50 g/L.
        6) Ceramic Tile Adhesives: 65 g/L.
        7) VCT and Asphalt Tile Adhesives: 50 g/L.
        8) Gypsum Board and Panel Adhesives: 50 g/L.
        9) Cove Base Adhesives: 50 g/L.
        10) Multipurpose Construction Adhesives: 70 g/L.
        11) Structural Glazing Adhesives: 100 g/L.
        12) Single-Ply Roof Membrane Adhesive: 250 g/L.
        13) Other Adhesives not specifically listed: 50 g/L.
        14) PVC Welding Compounds: 510 g/L.
        15) CPVC Welding Compounds: 490 g/L.
        16) ABS Welding Compounds: 325 g/L.
        17) Plastic Cement Welding Compounds: 250 g/L.
        18) Adhesive Primer for Plastic: 550 g/L.

19) Contact Adhesive: 80 g/L.
20) Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
21) Structural Wood Member Adhesive: 140 g/L.
22) Top and Trim Adhesive: 250 g/L.
23) Metal-to-Metal Adhesives: 30 g/L.
24) Plastic Foam Adhesives: 50 g/L.
25) Adhesives for Porous Materials (Except Wood): 50 g/L.
26) Wood Glues: 30 g/L.
27) Fiberglass Adhesives: 80 g/L.

b. Sealants: 2022 CGBSC Table 5.504.4.2, Sealant VOC Limit:

1) Architectural Sealants: 250 g/L.
2) Nonmembrane Roof Sealants: 300 g/L.
3) Paving Sealants: 250 g/L.
4) Single-Ply Roof Membrane Sealants: 450 g/L.
5) Other Sealants: 420 g/L.
6) Sealant Primers for Nonporous Substrates: 250 g/L.
7) Sealant Primers for Porous Substrates: 775 g/L.
8) Modified Bituminous Sealant Primers: 500 g/L.
9) Other Sealant Primers: 750 g/L.

3. Section 5.504.4.3, Paints and Coatings: Architectural Coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Paints and Coatings: 2022 CGBSC Table 5.504.4.3, VOC Content Limits for Architectural Coatings:

1) Flat Paints and Coatings: VOC not more than 50 g/L.
2) Nonflat Paints and Coatings: VOC not more than 100 g/L.
3) Nonflat High-Gloss Paints and Coatings: VOC not more than 150 g/L.
4) Dry-Fog Coatings: VOC not more than 150 g/L.
5) Floor Coatings: VOC not more than 100 g/L.
6) Pretreatment Wash Primers: VOC not more than 420 g/L.
7) Primers, Sealers, and Undercoaters: VOC not more than 100 g/L.
8) Rust Preventative Coatings Applied to Ferrous Metals: VOC not more than 250 g/L.
9) Shellacs, Clear: VOC not more than 730 g/L.
10) Shellacs, Pigmented: VOC not more than 550 g/L.
11) Stains: VOC not more than 250 g/L.
12) Clear Wood Finishes, Varnishes: VOC not more than 275 g/L.
13) Clear Wood Finishes, Lacquers: VOC not more than 275 g/L.
14) Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.

4. Section 5.504.4.3.1, Aerosol Paints and Coatings: Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of California Code of Regulations, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49. Comply with requirements of 2022 CGBSC, Table 5.504.4.3.

H. Carpet Systems: Comply with requirements of CGBSC, Section 5.504.4.4.

1. All carpet installed in the building interior shall meet the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

a. See California Department of Public Health’s website for certification programs and testing labs.

2. Carpet Adhesive: VOC content not exceeding 50 g/L per CGBSC Table 5.504.4.1 when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

I. Composite Wood Products: Comply with requirements of CGBSC Section 5.504.4.5; hardwood plywood, particleboard, and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB’s Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) Those materials not exempted by the ATCM must meet the specified emission limits, as shown in CGBSC Table 5.504.4.5.

J. Resilient Flooring Systems: Comply with requirements CGBSC, Section 5.504.4.6.

1. Where resilient flooring is installed, at least 80% of floor area receiving resilient flooring shall meet the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

2. Resilient Floor Adhesive: VOC content not exceeding 50 g/L per CGBSC Table 5.504.4.1 when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

K. HVAC Filters: Comply with requirements CGBSC, Section 5.504.5.3; in mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media for outside and return air prior to occupancy that provides at least a Minimum Efficiency Reporting Value (MERV) of 13. MERV 13 filters shall be installed prior to occupancy and recommendations for maintenance with filters of the same value shall be included in the operation and maintenance manual.

1. Exception: Existing mechanical equipment.

2. Labeling: Installed filters shall be clearly labeled by the manufacturer indicating the MERV rating.

L. Outside Air Delivery: Comply with requirements CGBSC, Section 5.506.1; for mechanically or naturally ventilated spaces in buildings, meet the minimum requirements of Section 120.1 (Requirements For Ventilation) of the 2022 California Energy Code, or the applicable local code, whichever is more stringent, and Division 1, Chapter 4 of CCR, Title 8.

M. Acoustical Control: Comply with requirements CGBSC, Section 5.507.4, employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E 90 and ASTM E 413 or Outdoor–Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E 1332, using either the prescriptive or performance method in CGBSC Section 5.507.4.1 or 5.507.4.2.

1. Exception:

a. Buildings with few or no occupants or where occupants are not likely to be affected by exterior noise, as determined by the enforcement authority, such as factories, stadiums, storage, enclosed parking structures and utility buildings.
b. Exception: For public schools and community colleges, the requirements of CGBSC Section 5.507.4, and all subsections, apply only to new construction.

N. Interior Sound Transmission: Comply with requirements CGBSC, Section 5.507.4.3; wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.

O. Ozone Depletion and Greenhouse Gas Reductions: Comply with requirements CGBSC, Section 5.508.1; installation of HVAC, refrigeration, and fire suppression equipment shall comply with CGBSC Sections 5.508.1.1 and 5.508.1.2.

1. Chlorofluorocarbons (CFCs): Install HVAC, refrigeration and fire suppression equipment that do not contain CFCs.
2. Halons: Install HVAC, refrigeration and fire suppression equipment that do not contain Halons.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 019113
GENERAL COMMISSIONING 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.

B. Owner's Project Requirements (OPR) and Basis of Design (BoD) documentation are included by reference for information only.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:

1. Division 23 Section "Commissioning of HVAC Systems" for commissioning process activities for HVAC systems, assemblies, equipment, and components.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and each Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 EACH CONTRACTOR'S RESPONSIBILITIES

A. Each Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a regularly scheduled basis.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete paper and/or electronic construction checklists as Work is completed and provide to the Commissioning Authority on a predetermined daily or weekly basis.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 023000
SUBSURFACE INVESTIGATION

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 information for the Geotechnical Investigation Report prepared for this Project.

B. Related Sections:

1. Division 31 Sections as applicable to site clearing, earthwork, excavations, fill, trenching, and paving.

1.3 GEOTECHNICAL REPORT

A. A Geotechnical report for this project is currently underway. For reference only, a copy of a recent Geotechnical Investigation Report of an adjacent site is contained in the Appendix of this Project Manual.

B. A Geotechnical report for the Building has been prepared by:

Krazan & Associates, Inc.
215 W. Dakota Avenue
CLovis, CA 93612
(559) 348-2200

KA No. 012-24185

C. N/A.

D. The Geotechnical Investigation Report identifies subsurface soil and ground water conditions and offers recommendations for earthwork and preparation of subsurface conditions for the Work of this Project.

E. The Geotechnical Investigation Report is not a warranty of subsurface conditions. Should subsurface conditions be found to vary substantially from the Report, changes in design and construction of foundations may be made by the Architect, with resulting credits or expenditures to the Contract sum accruing to the Owner.

1.4 QUALITY ASSURANCE

A. A soil engineer will be retained by the Owner to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

1. Requirements for Field Quality Control are included in individual Sections as applicable to excavating, trenching, filling, backfilling, and grading.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 024119
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. This Section includes the following:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused, recycled, or returned to Owner.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
2. Division 01 Section "Photographic Documentation" for photographic documentation of pre-demolition conditions.
3. Division 01 Section "Execution" for cutting and patching procedures.
4. Division 01 Section “Construction Waste Management and Disposal” for salvaging, recycling, and disposing of nonhazardous demolition and construction waste.
5. Division 09 Sections as applicable to adhered floor systems.
6. Prior to Bid Owner will provide “Asbestos & Lead Inspection Report” for the results of the inspection of the existing project conditions and materials.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be salvaged or reinstalled.

B. Remove and Salvage to Owner: Detach item from existing construction in a manner to prevent damage and deliver to Owner ready for reuse.

C. Remove and Salvage for Reinstallation: Detach item from existing construction in a manner to prevent damage, prepare for reuse, and securely store item until it is to be reinstalled at locations indicated.

D. Existing to Remain: Existing items or improvements that are to remain and not be removed. Existing items to remain shall be protected from damage during the course of construction.

1.4 MATERIALS OWNERSHIP

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

1.5 SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for physical damage, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site 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. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Qualification Data: For refrigerant recovery technician.

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

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

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

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

C. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition.

1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Hazardous materials are known to be present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

E. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

F. Storage or sale of removed items or materials on-site is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

1. If unanticipated mechanical, electrical, or structural elements are encountered and found to be in conflict with intended function or design, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

C. Inventory and record the condition of items to be removed and salvaged or removed and reinstalled. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

A. 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.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. 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.
2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. 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.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Shoring: 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.

1. Strengthen or add new supports when required during progress of selective demolition.

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

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

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

C. 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. Arrange to shut off utilities with Owner and/or utility companies.
2. 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.
3. 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 and Salvaged: 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 SELECTIVE DEMOLITION, GENERAL

A. General: Remove existing construction only to the extent required by new construction and as indicated. 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, to minimize disturbance of adjacent surfaces. 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 plasma or flame cutting torches without written approval from Architect. Where allowed, clear area 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. Maintain fire watch during and for at least two hours after flame-cutting operations. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
7. Dispose of demolished items and materials promptly, comply with requirements of Division 01 Section “Construction Waste Management and Disposal.”

B. Minor Accessories and Fixtures: Remove minor accessories and fixtures as required to accommodate removal of existing finishes or application new finishes whether items are indicated to be removed or not.

1. Minor accessories and fixtures shall include but not be limited to toilet room accessories; classroom accessories such as pencil sharpeners coat hooks, flag holders, and similar items.
2. Where new replacement items are not indicated or specified in other sections, minor accessories and fixtures shall be considered to be items to be removed and reinstalled.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area.
5. 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.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. 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 Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

1. Items removed, salvaged, and reinstalled for the Contractor's convenience shall be considered the same as items to be removed and salvaged for reinstallation.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete Slabs-on-Grade: Using power-driven saw, cut perimeter of area to be demolished, then break up and remove.

1. Where possible or feasible, cut concrete at existing joints.

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

C. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to applicable Division 07 Section for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Recycle or dispose demolition waste materials according to Division 01 Section "Construction Waste Management and Disposal." Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in accordance with local regulations and in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.8 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

SECTION 030516
UNDERSLAB VAPOR BARRIER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sheet vapor barrier under concrete slabs on grade.

1.02 ACTION SUBMITTALS

A. Product Data: Submit manufacturers' data on manufactured products.

B. Samples: Submit samples of underslab vapor barrier to be used.

C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Under slab Vapor Barrier:
   1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
   2. Thickness: 15 mils.
   3. Basis of Design:
      a) Stego Industries LLC; Stego Wrap Vapor Barrier (15 mil): www.stegoindustries.com/#sle.
      b) Substitutions: See section012500 – Substitution Procedures

B. Accessory products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc. , for sealing seams and penetrations in vapor barrier.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION 030516

SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel reinforcement bars.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Each type of steel reinforcement.
   2. Zinc repair material.
   3. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:
   1. Include placing drawings that detail fabrication, bending, and placement.
   2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
   1. Location of construction joints is subject to approval of Architect.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.
   1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4.

B. Material Test Reports: For the following, from a qualified testing agency:
   1. Steel Reinforcement:
      a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
   1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 with min. 80 KSI tensile strength per DSA BU 24-02, deformed, unless noted otherwise on structural drawings.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706, deformed.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
   1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with 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, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Steel Tie Wire: ASTM A1064, annealed steel, not less than 0.0508 inch in diameter.
   1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
   1. Do not cut or puncture vapor retarder.
   2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.
   1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
   2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.
   1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
   2. Stagger splices in accordance with ACI 318.
   3. Weld reinforcing bars in accordance with AWS D1.4, where indicated on Drawings.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement.
   2. Continue reinforcement across construction joints unless otherwise indicated.
   3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and 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.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.
   1. Portland cement.
   2. Fly ash.
   3. Slag cement.
   4. Blended hydraulic cement.
   5. Silica fume.
   6. Aggregates.
   7. Admixtures:
      a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
   8. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:
   1. Mixture identification.
   2. Minimum 28-day compressive strength.
   3. Durability exposure class.
   4. Maximum w/cm.
   5. Slump limit.
   6. Air content.
   7. Nominal maximum aggregate size.

8. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
9. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Bonding agents.
4. Adhesives.
5. Vapor retarders.
6. Repair materials.

B. Research Reports:
1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

C. Preconstruction Test Reports: For each mix design.

1.5 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
2. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
   1. Include the following information in each test report:
      a. Admixture dosage rates.
      b. Slump.
      c. Air content.
      d. Seven-day compressive strength.
      e. 28-day compressive strength.
      f. Permeability.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
   1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   3. Do not use frozen materials or materials containing ice or snow.
   4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
   5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
   1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, Type V, gray. Unless noted otherwise on structural drawings.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, Type IP, portland-pozzolan cement.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.

2.3 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, in accordance with ACI 301.
1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Other Pozzolans: 15 percent by mass.
2. Slag Cement: 25 percent by mass.
3. Silica Fume: 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a w/cm below 0.50.

2.4 CONCRETE MIXTURES

A. Normal-weight concrete used for footings, grade beams, and slab-on-grade.
   1. Exposure Class: ACI 318 **S2**
   2. Minimum Compressive Strength: 3000 psi at 28 days unless noted otherwise.
   3. Maximum w/cm: 0.45 unless noted otherwise.
   4. Slump Limit: As noted on the drawings
   5. Limit water-soluble, chloride-ion content in hardened concrete to **0.30** percent by weight of cement.

2.5 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
   1. Daily access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
   4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF 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.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
   1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
   2. Face laps away from exposed direction of concrete pour.
   3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
   4. Lap joints 6 inches and seal with manufacturer's recommended tape.
   5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
   6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
   7. Protect vapor retarder during placement of reinforcement and concrete.
      a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
   1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
   2. Place joints perpendicular to main reinforcement.
      a. Continue reinforcement across construction joints unless otherwise indicated.
      b. Do not continue reinforcement through sides of strip placements of floors and slabs.
   3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.

2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
   1. If a section cannot be placed continuously, provide construction joints as indicated.
   2. Deposit concrete to avoid segregation.
   3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
      a. Do not use vibrators to transport concrete inside forms.
      b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
      c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
      d. 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.

F. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Do not place concrete slabs in a checkerboard sequence.
   2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Maintain reinforcement in position on chairs during concrete placement.
   4. Screed slab surfaces with a straightedge and strike off to correct elevations.
   5. Level concrete, cut high areas, and fill low areas.
   6. Slope surfaces uniformly to drains where required.
   7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
   8. Do not further disturb slab surfaces before starting finishing operations.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
   1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.

2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases as indicated on approved construction drawings.
3. Minimum Compressive Strength as indicated on approved construction drawings.
4. Prior to pouring concrete, place and secure anchorage devices.
   a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Cast anchor-bolt insert into bases.
   c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

3.8 TOLERANCES

A. Conform to ACI 117.

3.9 CONCRETE SURFACE REPAIRS

A. Defective Concrete:
1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
   a. Limit cut depth to 3/4 inch
   b. Make edges of cuts perpendicular to concrete surface.

c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
   a. Correct low and high areas.
   b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
   a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
   a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
   a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.

b. Dampen cleaned concrete surfaces and apply bonding agent.
c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:
1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete
a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M:
a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M:

a. Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.
   a. Test one set of three laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of three field-cured specimens at seven days and one set of two specimens at 28 days.
   c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. 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.
8. Additional Tests:
   a. Testing and inspecting agency to 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.
   b. 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.
9. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
10. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.11 PROTECTION

A. Protect concrete surfaces as follows:
   1. Protect from petroleum stains.
   2. Prohibit vehicles from interior concrete slabs.
   3. Prohibit use of pipe-cutting machinery over concrete surfaces.
   4. Prohibit placement of steel items on concrete surfaces.
   5. Prohibit use of acids or acidic detergents over concrete surfaces.
   6. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 033500
CONCRETE FLOOR FINISHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Finishing of exposed formed concrete.
   2. Final slab finishing and curing.
   3. Colored concrete.
   4. Tooled joints.
   5. This Section does **not** apply to slabs designated to receive a polished concrete finish. Refer to Section 03 35 43.

B. Related Sections include the following:
   1. Division-3 section “Cast-In-Place Concrete” for structural requirements.
   2. Section 03 35 43 "Polished Concrete Finishing" for all requirements related to slabs designated to receive a polished finish, including base slab flatness, curing, and finishing prerequisites.

1.3 DEFINITIONS:

A. Flatness: Degree to which surface approximates plane.

B. Levelness: Degree to which line or surface parallels horizontal. Horizontal is normal to direction of gravity.

C. Envelope: Vertical distance between two level lines or planes.

D. Specified Overall Value: Composite value of samples taken at given level, regardless of number of concrete placements required to complete level. Specified overall F numbers represent minimum values allowed for entire floor, looked at as whole.

E. Minimum Local Value: Minimum local F(F) or F(L) value at given level, taken within one floor test area defined as Minimum Local Area. Boundaries of Minimum Local Areas may not cross construction joints. For slabs-on grade, Minimum Local Area will be bounded by construction and/or control joints, or by column lines and half-column lines, whichever is smaller. For elevated slabs, Minimum Local Area will be bounded by column lines and/or half-column lines.

1.4 QUALITY ASSURANCE

A. Tolerances:
   1. Tolerances for Concrete Construction and Materials shall conform to requirements

of ACI 117 (1), "Standard Specifications for Tolerance for Concrete Construction and Materials, ACI 301, Specification for Structural Concrete for Buildings, and ACI 302, Guide for Concrete Floor and Slab Construction, except as modified by requirements of these Contract Documents. Form offsets may conform to ACI 117, Section 4.5.4, except this shall not operate to relieve Contractor of providing specified finish of formed surfaces.

2. Floor finish tolerances for surfaces designated to receive troweled finish shall be measured in accordance with ACI 117 (2), Section 4.5.6, except as modified by these Contract Documents. Refer to Division-3 section “Cast In-Place Concrete” for screeding and crack control requirements, related suggestions, and for Flatness and Levelness Inspection, and curing requirements.

B. Regulatory Requirements:
   1. Comply with all applicable requirements of the laws, codes, ordinances and regulations of Federal, Regional, and State authorities having jurisdiction. Obtain necessary approvals from all such authorities.
   2. Comply with South Coast Air Quality Management District (SCAQMD) regulations controlling use of volatile organic compounds (VOC’s)

1.5 SUBMITTALS

A. Product Data: Submit for the following:
   1. Continuous inserts for crack control.
   2. Curing-sealer-hardener.
   3. Bonding agents.
   4. Concrete topping products.

B. Color Samples: Obtain the Architect’s instructions and submit a range of manufacturer's corresponding custom colors for color admix.

C. Crack Control Joint Locations in Slabs-on-Grade: Submit plan showing location of proposed construction joints and control joints for review by the Architect (AOR) prior to concrete slab on grade placement. Include proposed time frame for installation of control joints if by sawcutting methods as specified herein.

D. Site Samples: Prepare Samples at the site, cast in approved locations and orientations. Prepare as many Samples of each type of concrete as are required for approval. Remove Samples from the site when no longer needed and removal is approved. Approved Samples may be part of permanent construction if meeting all other requirements shown and specified and are so approved. Use form and concrete materials previously approved under Division-3 sections “Concrete Formwork” and “Cast-In-Place Concrete".
   1. Slab Samples: Prepare minimum 4-foot square Samples of each required slab finish excluding only monolithic trowel and steel float finishes. Include a transverse expansion joint, scoring, and edging.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of concrete finishes that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year.

B. Installer's Warranty: 1 year.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish materials conforming to Division-3 section "Cast-In-Place Concrete" as applicable, and the following requirements:

PART 3 - EXECUTION

3.1 FINISHING EXPOSED FORMED CONCRETE

A. Surface patching and initial curing of formed concrete are specified in Division-3 section "Cast-In-Place Concrete". Rub surfaces with a carborundum brick or equal until smooth and free of form marks, offsets, and other defects, and in uniform planes. Wet rubbed surface and then brush coat with cement grout consisting of 1 part light-colored Portland cement to 2 parts fine aggregate and mixed with water to the consistency of thick paint. Cork or wood float grout to fill all pits, air bubbles, and surface holes. Scrape off excess grout and rub surface with burlap or equal to remove all grout film. After grout sets, again coat with same grout, cure, then brick and burlap rub as necessary to eliminate remaining defects and blemishes, and damp cure surfaces for not less than 3 days or longer if required for complete curing of concrete. Finish, clean, and cure each surface as a continuous operation. Produce uniformly plane smooth surfaces free of grout film, grout or rubbing marks, defects, or blemishes after painting or covering with a flexible type finish material. Unless otherwise indicated or specified, apply this finish on exposed formed concrete, exposed concrete at the building foundation, and where indicated or scheduled.

3.2 SLAB FINISHES

A. Concrete slabs shall be level or sloped as indicated with maximum deviation as listed below. Keep surface moist with a fine fog spray of water as necessary. Dusting with dry cement or sand during finishing operations is prohibited. Finish slab edges and joints with an edging tool. Match approved Sample panels. Conform to the following requirements and apply the following finishes as indicated, specified, approved, and applicable.

B. Slab Finishing:
1. Refer to Division-3 section "Cast-In-Place Concrete" for screeding requirements at elevated slabs.
2. After concrete has been placed, struck off, consolidated, and restraightened, concrete shall not be worked further until ready for floating. Restraightening operation is best accomplished by use of 8 foot to 10 foot wide bull float. Power floating operations shall begin when the water sheen has disappeared, and when the mix has stiffened sufficiently to permit proper operation of power-driven float.

3. Consolidate surface with power-driven floats. Hand floating with wood or cork

faced floats shall be used in locations inaccessible to power driven machine. Surface shall be restraightened at this stage with ten foot highway straightedge applied at not less than two different angles.

4. Finish surfaces to tolerances of F(F)-18 (floor flatness) and F(L)-15 (floor levelness) measured according to ASTM E 1155. Minimum Local Value of F(F)-15 and F(L)-10.
5. High spots shall be cut down and low spots filled during this procedure to produce planes checking true under straightedge in any direction. Uniformly slope surfaces to drains where occurs.
6. Restraightening operation shall be followed by final float pass to uniform, smooth, granular texture.

C. Rough Slab Finish: Apply to monolithic slab surfaces to receive trowel finish, unbonded concrete floor topping, and other finishes as specified.

D. Steel Trowel Finish: Apply to monolithic slab surfaces exposed to view and slab surfaces to be covered with membrane waterproofing, membrane roofing, mortar setting bed for tile resilient flooring, carpet, paint, or other thin-film finish coating system.

1. First stages of producing trowel finish shall match procedures described for rough finish.
2. Perform first trowel finish operation with power-driven trowel to produce smooth surface which is relatively free to defects but may still contain some trowel marks. Additional trowelings with power-driven trowel may be necessary.
3. Perform final troweling with hand trowels after surface has hardened sufficiently to produce ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, and uniform in texture and appearance.
4. Finish surfaces to F(F) and F(L) tolerances specified herein.
5. Repair defects of sufficient magnitude to telegraph through floor covering by grinding or by application of topping. Refer to Remedy For Out of-Tolerance Floor Surfaces for additional remedial measures.
6. Apply on following areas and surfaces:
    a. Resilient floor covering areas.
    b. Carpet tile areas.
    c. Elastomeric coating areas.
    d. Traffic deck coating areas.
    e. Thin-set tile areas.
    f. Roof slabs.
    g. Slabs to receive membrane waterproofing.
    h. Slabs to receive fluid-applied waterproofing.

E. Float Finish: Same as for monolithic steel trowel finish less the second retroweling. When ready, apply approved coarse texture finish with a trowel. At walking areas, smooth finish 1" wide at edges, expansion joints, and scoring. Apply on the following surfaces unless otherwise indicated:

1. Exterior vehicle traffic slabs and ramps.
2. Exterior concrete walks.
3. Other slabs where indicated or approved by Architect (AOR).

F. Fine-Broom Finish: Apply first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

G. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.3 CURING

A. Cure concrete slabs in accordance with Division 03 Section "Cast-In-Place Concrete."

B. **EXCEPTION:** For all slabs designated to receive a polished concrete finish, **do not use liquid membrane-forming curing compounds**, curing-sealer-hardeners, or any other product that will inhibit the penetration of polishing densifiers. Refer to Section 03 35 43 for all curing requirements.

3.4 FIELD QUALITY CONTROL

A. Floor Tolerance Measurements:
   1. Requirements, criteria, and time period for measuring and reporting for Flatness and Levelness Inspection of Floor Slabs is specified in Division-3 section “Cast In-Place Concrete”.
   2. Where normal data collection under provisions of ASTM E1155 indicates possibility of work below Minimum Local Value, additional data may be required to confirm extent, or boundary, of that defective work. If area is identified as not meeting specified Minimum Local Value, area in question shall be replaced or repaired in accordance with provisions of Remedy For Out-of Tolerance Floor Surfaces, along Minimum Local Area boundaries.
   3. Correct work that does not meet specified tolerances required herein. Refer to Remedy For Out-of-Tolerance Floor Surfaces.
   4. Additional testing to confirm boundary of defective or out of-tolerance work shall be at Contractor's expense.
   5. Contractor shall include additional concrete required to achieve specified slab surface tolerances. Refer to Division-3 section “Cast-In-Place Concrete”.
   6. Finish Tolerances: Floor slabs and concrete toppings designated to receive troweled finish shall conform to following ACI F-number requirements: Floor levelness, F(L), does not apply to elevated slabs on metal deck and steel beam framing system. Floor levelness, F(L), does apply to concrete toppings over elevated slab surfaces.
      a. Slabs-on-Grade, Concrete topping over slabs-on-grade:
         1) Typical values, unless noted otherwise:
            a) Specified Overall Value: F(F)-25/F(L)-20.
            b) Minimum Local Value: F(F)-17'/F(L)-14.
         2) To receive thin set tile or resilient flooring:
            a) Specified Overall Value: F(F)-35/F(L)-20.
            b) Minimum Local Value: F(F)-27/F(L)-14.

B. Floor Elevation Tolerances:
   1. When tested in accordance with requirements of ASTM E 1155, following percentages of elevation samples on floor slabs at single elevation shall fall within level 3/4 inch envelope centered about mean elevation of readings.
      a. Slabs on Grade: 85 percent.
   2. Arithmetic mean of these elevation samples shall not deviate from design grade

more than following amounts:
a. Slabs-on-Grade: 1/4 inch, plus or minus.

C. Tolerances for Polished Slabs:
1. Floor slabs designated to receive a polished finish shall conform to the more stringent tolerance requirements specified in Section 03 35 43 "Polished Concrete Finishing," including Specified Overall Value: F(F) 40 / F(L) 30.

2. The tolerances listed in this Section do not apply to polished concrete areas.

3.5 REMEDY FOR OUT OF TOLERANCE FLOOR SURFACES

A. General:
1. Remedial work, testing, retesting, and consulting services necessary to correct out-of-tolerance floor surfaces shall be at Contractor's expense with no extension to construction schedule.
2. Repair and replacement procedures, limits, and products shall be in manner that does not diminish the desired appearance or serviceability of structure and shall be approved by Architect of Record (AOR) and Structural Engineer of Record (SEOR). Contractor shall submit detailed work plan for areas where remedial measures are necessary, prior to remedial work. Include following information:
a. Specific boundaries of area to receive remedial work.
b. Methods and products proposed.
c. Grout/topping/underlayment product literature.

B. Remedial Measures:
1. Slabs-on-Grade: Minimum Local Areas measuring below either or both of specified Minimum Local Values shall be removed, replaced, and retested unless approved by AOR and SEOR.
2. Elevated Slabs: Minimum Local Areas measuring below specified Minimum Local Value(s) shall be repaired by grinding or by application of topping or underlayment to entire surface of Minimum Local Area, and retested, unless following conditions occur:
a. Such area is approved by AOR and SEOR, and written acceptance is provided.
b. Repair of such area would diminish desired appearance and serviceability of structure, or is in general considered unacceptable to DSA for other reasons, in which case Minimum Local Area shall be replaced and retested.
3. Structural Repairs: Are applicable to defects described above at structural load-bearing members where structural integrity of structure is affected.
4. Locations shall be approved by OSHPD.
5. Perform structural repairs with prior approval of the AOR and SEOR for method and procedure using specified bonding compound and mortar.

C. Exceptions for Polished Slabs:
1. The remedial measures in this Section, particularly the use of toppings or cast underlayment (Section 03 54 00), are **not permitted** for slabs designated to receive a polished finish.

2. Remedial work for out-of-tolerance slabs in polished areas shall be submitted for review and must be approved by the Architect and the Polished Concrete Installer. Non-compliant slabs may require full removal and replacement.

3.6 CLEANUP AND PROTECTION

A. Construction Waste Management:
   1. At end of each work day, recycle or dispose of unused materials, debris, and containers.

B. Protect the Work so it will not deteriorate or be damaged. Remove protection at time of Substantial Completion.

END OF SECTION 033500

SECTION 033543
POLISHED CONCRETE FINISHING

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. Polished concrete finishing including grinding, honing, scoring, and sealing.

2. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Division 03 Section "Cast-in-Place Concrete."

B. Related Sections:

1. Division 03 Section "Cast-Place Concrete" for concrete not designated as polished or stained concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. 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. Ready-mix concrete manufacturer representative.
c. Cast-in-place concrete subcontractor.
d. Polished concrete finishing Subcontractor.

2. Review and discuss the following:

a. Construction joints.
b. Concrete repair procedures.
c. Concrete finishing.
d. Protection of polished concrete.
e. Curing procedures.
f. Concrete floor flatness (F_F) and levelness F_L) requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product incorporated into the Work, include product data, application instructions and VOC content for liquid products.

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 for Initial Selection: For each type of product requiring color selection.

D. Samples for Verification: For each type of exposed color.

E. Field Quality Control Reports: for dynamic and static coefficient of friction test reports.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For instructions to include in maintenance documentation.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity experienced in performing work similar in design, products, and extent to the scope of this Project, with a record of successful in-service performance for not less than 3 years, and with sufficient production capability, facilities, and personnel to produce specified work.

B. Walkway Auditor: Certified by CPAA or NFSI to test bonded abrasive polished concrete floors for dynamic and static coefficient of friction according to ANSI B 101.1 and B 101.3.

C. Mockups: 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:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Demonstrate curing, finishing, and protecting of polished concrete.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity which complies with manufacturer’s written instructions.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply floor system within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply products to damp or wet substrates, when temperatures are below 65 deg F, or above 85 deg F.

B. Protection Prior to Polishing Concrete: Protect concrete floor areas to be polished as follows prior to finishing:

1. Prohibit use of markers, spray paint, and soapstone.
2. Prohibit improper application of liquid membrane film forming curing compounds.
3. Prohibit vehicle parking over concrete surfaces.
4. Prohibit pipe-cutting operations over concrete surfaces.
5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
6. Prohibit ferrous metals storage over concrete surfaces.
7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
8. Protect from acids and acidic detergents contacting concrete surfaces.
9. Protect from painting activities over concrete surfaces.

C. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F.

D. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

E. Close spaces to traffic during application and for not less than 24 hours after application unless manufacturer recommends a longer period.

F. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.10 COORDINATION

A. Coordinate requirements for concrete slab materials, mixes, finishing, and curing with Division 03 Section “Cast-in-Place Concrete.” Cast-in-Place Concrete for slabs to be polished and stained shall comply with the following:

1. Portland Cement: ASTM C 150, Type I or Type II.
2. Aggregates: Uniformly graded mix of fine, intermediate, and large aggregates.
3. Strength: 3,500 psi minimum at 28 days.
4. Water-Cement Ratio: 0.45 maximum.
5. Slump: 4 inches +/- 1/2 inch.
6. Curing: Do not use curing compounds.
7. Admixtures: Admixtures containing more than 0.05% chloride ions are not permitted.
8. Concrete shall not be air entrained.
9. Flatness and Levelness: FF 40 minimum, FL 30 minimum.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

A. Material Compatibility: Provide liquid floor treatment materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Manufacturer: Subject to compliance with requirements, provide liquid floor treatment products by one of the following manufacturers:

1. Advanced Floor Products.
2. Ardex Americas.
3. BASF Construction Chemicals.
4. Lythic/Solomon Colors Inc.
5. PROSOCO.
6. Sika/Scofield.

C. Product Source Requirements: Obtain liquid floor treatment products from a single source from a single manufacturer.

D. VOC Content of Liquid Products: In compliance with the California Green Building Standards Code.

E. Liquid Densifier: Clear, waterborne, odorless inorganic aqueous solution of silicon dioxide and proprietary components dissolved in lithium silicate hydroxide that penetrates into the concrete surface and reacts with the calcium hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete and is suitable for polished concrete surfaces.

F. Wear Protection: Lithium fortified stain and wear protection finish for deep penetration, increased surface hardness and superior reflectivity on concrete.

G. Surface Cleaner: Water based surface cleaner as recommended by liquid floor treatment manufacturer.

1. pH Level: 10.0 pH, non-hazardous waste per EPA requirements.

H. Additional Liquid Floor Treatment Products: Products as recommended in writing by liquid floor treatment manufacturer and concrete polishing contractor.

2.2 ACCESSORY MATERIALS

A. General: Provide accessory materials as recommended in writing by liquid floor treatment product manufacturer.

B. Repair Material: A cementitious product that is designed for repairing cracks and surface imperfections in concrete substrates. The repair material shall have sufficient bonding capabilities to remain adhered to concreter substrates after polishing operations, and to provide abrasion resistance equal to or greater than the surrounding concrete substrate. Repair materials shall be compatible with liquid applied products.

C. Grout Material: A thin mortar for filling spaces, provide one of the following:

1. Epoxy, urethane, polyurea, or polyaspartic resins.
2. Latex or acrylic binders mixed with cement dust from previous grinding steps.
3. Silicate binders mixed with cement dust from previous grinding steps.

D. Joint Filler: A semi-rigid polyurea joint sealant with 100% solids.

1. Acceptable Product: Metger/McGuire; Spal-Pro RS 65 or approved equivalent.
2. Color: Clear.
3. Hardness: Shore A at 70 Deg. F, ASTM D 2240, Results A64-69.
4. Tensile Elongation: 162% at 70 Deg. F, ASTM D 412.
5. Tensile Strength: 393 psi at 70 Deg. F, ASTM D 412.

2.3 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:

1. General: A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
2. Dry Grinding Equipment: If dry grinding, honing, or polishing; use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments to meet OSHA requirements.
3. Wet Grinding Equipment: If wet grinding, honing, or polishing; use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces the same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.

1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e. hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
3. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, and thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.
4. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.
5. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
6. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of the Work.

B. Proceed with installation only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Before applying finish system, clean and prepare substrates according to manufacturer's written instructions. Remove projections, fill voids, and seal joints if any, as recommended in writing by manufacturer. Repair concrete substrates to comply with requirements for concrete staining and polishing.

B. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

C. Mask adjoining surfaces not receiving coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent coating materials from entering substrate penetrations and clogging weep holes and drains.

D. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

E. Remove grease, oil, form release agents, paints, curing compounds, and other penetrating contaminants or film forming coatings from concrete.

F. Mechanically abrade concrete substrates by methods and with equipment recommended by floor system manufacturer. Grinding and polishing equipment shall be connected to a dust collection apparatus.

3.3 CONCRETE SUBSTRATE REPAIR

A. Cracks: Crack repair shall be completed after the first grinding and floor cleaning; comply with flooring system manufacturer’s written instructions.

B. Spalls: Spall repair shall be completed after the first grinding and floor cleaning or prior to the beginning of the floor system process installation; comply with flooring system manufacturer’s written instructions.

3.4 JOINT FILLING

A. Joint Filling: Prepare joints and install joint filling materials in accordance with joint filler manufacturer’s recommendations.

1. Joint filler shall not be installed in newly placed concrete slabs until slabs have cured not less than 30 days.
2. Joints shall be filled after the first grinding pass and floor cleaning before any subsequent grinding passes.

3. Fill joints in one pass, 1/2 inch deep over closed cell compressible backer rod.

3.5 POLISHING

A. General: Use grinding and polishing steps and grits as recommended in writing by floor system manufacturer to achieve the desired level of cut and level of gloss and to match accepted mockup.

1. Perform all polishing procedures to ensure a consistent visual appearance from wall to wall.
2. Control and dispose of waste products produced by grinding and polishing operations.
3. Neutralize and clean polished floor surfaces.
4. Apply dyes, densifiers and finish treatments between grinding/polishing/burnishing operations and at rates recommended in writing by flooring system manufacturer.
5. Polished edge work shall be done with hand held or walk behind equipment and shall be finished to a level matching the field of the floor system.

B. Initial Grinding:

1. Use grinding equipment with metal or semi-metal bonded tooling.
2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, limit change in grit values to not more than double the grit value of the previous pass.
4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
6. Continue grinding until aggregate surface exposure matches approved field mock-up.

C. Treating Surface Imperfections:

1. Mix patching compound or grout material with dust created by grinding operations, manufacturer’s tint, or sand to match color of adjacent concrete surfaces.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections, compared to mockup, are not reasonably noticeable when viewed from 20 feet away under lighting conditions that will be present after construction.

D. Grout Grinding:

1. Use grinding equipment and appropriate grit and bond diamond tooling.
2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

E. Honing:

1. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
2. Use grinding equipment with hybrid or resin bonded tooling.
3. Hone concrete in one direction starting with 120/140 grit tooling and increasing to 200 grit making as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, reaching maximum refinement with each pass before proceeding to finer grit tooling.
4. Apply colorants and densifiers in accordance with liquid floor treatment manufacturer's written instructions.
5. Hone concrete in one direction with 400 grit tooling making as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, reaching maximum refinement with each pass before proceeding.

F. Polishing:

1. Use polishing equipment with resin-bonded tooling.
2. Begin polishing in one direction starting with 800 grit tooling.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of appearance has been achieved.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
6. Apply wear protection products in accordance with liquid floor treatment manufacturer's written instructions. Final film thickness should be less than .05 mils after cure.
7. Achieve final polish using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

3.6 FIELD QUALITY CONTROL

A. Testing: Provide field quality control testing confirming compliance with specified performance criteria.

1. Slip Resistance: Measure slip resistance using a BOT-3000 Slip-tester, ensure compliance with slip resistance rating.

3.7 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of polished floor system.

1. Protect from spills and contamination.
2. Avoid moisture for not less than 72 hours after completion of floor finish system.
3. Limit pedestrian traffic for not less than24 hours after completion and not less than 7 days for other traffic.

B. Remove grinding dust from installation and adjacent areas. Clean surfaces according to manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that polished flooring is without damage or deterioration at time of Substantial Completion.

3.8 POLISHED CONCRETE FLOOR FINISH LEVEL

A. Polish concrete floors to achieve the following finish:

1. Coefficient of Friction: Achieve the following coefficient of friction values for level floor surfaces:

   a. Static Coefficient of Friction: 0.42 minimum, ANSI B 101.1.
   b. Dynamic Coefficient of Friction: 0.35 minimum, ANSI B 101.3.

2. Aggregate Exposure: Class B, Fine/Sand Aggregate Finish. Surface exposure of 85 to 95% fine aggregate and 5 to 15% cement fines and coarse aggregate based on visual observation of the overall area of the polished floor.
3. Gloss Level: Level 3, semi-polished gloss/high sheen, 800 grit.

END OF SECTION

SECTION 035400
CAST UNDERLAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.

1. Use gypsum-based type at dry areas; classrooms, administrative, storage and similar applications.
2. Use cementitious type at Wet areas; restrooms, custodial and similar applications.

1.2 RELATED SECTIONS

A. Pertinent sections specifying substrates to receive underlayment.

B. Pertinent sections specifying floor finishes installed over underlayment.

C. Pertinent sections specifying work penetrating floors and underlayment.

1.3 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).

B. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.

C. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. See Division 01 for 3300 - Submittals

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation.

1.5 QUALITY ASSURANCE

A. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

B. Construct mock-up of underlayment material, 12 feet long by 12 feet wide, illustrating specified characteristics.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.7 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures within the manufacturer's recommended range during and after installation of underlayment.

C. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.

D. During the curing process, ventilate spaces to remove excess moisture.

1.8 SEQUENCING

A. Scheduling: Install after roof, windows, doors, and other openings in the building envelope is permanently closed with final construction. Install after gypsum board installation unless tenant finish requirements identify participating after placement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Gypsum Underlayment:

1. ARDEX Engineered Cements; ARDEX K 22 F: www.ardexamericas.com/#sle.
2. Maxxon Corp.; Product "Gyp-Crete 2000": www.maxxon.com, is specified.
3. U.S. Gypsum Corporation, Product "Level-Rock 2100", www.gypsumsolutions.com.

B. Cementitious Underlayment:

1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
2. LATICRETE International, Inc; LATICRETE SUPERCAP SC500 with LATICRETE SUPERCAP Primer Plus: www.laticretesupercap.com/#sle.

2.2 MATERIALS

A. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:

1. Compressive Strength: Minimum 2500 psi, tested per ASTM C472.
2. Density: Maximum 115 lb/cu ft.
3. Final Set Time: 1 to 2 hours, maximum.

4. Thickness: 3/4 inch to maximum 3-1/2 inch.
5. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:

1. Compressive Strength: Minimum 4000 psi after 28 days, tested per ASTM C109/C109M.
2. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
3. Density: 125 lb/cu ft, nominal.
4. Final Set Time: 1-1/2 to 2 hours, maximum.
5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Sand Aggregate: Washed masonry or plaster sand, 1/8 inch or less, manufacturer's recommended type.

D. Water: Potable and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

G. Sealer: Manufacturer's recommended type.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to achieve following characteristics:

1. Density: 115 lb/cu ft minimum dry density.
2. Compressive Strength: galvanized2,500 psi minimum in accordance with ASTM C 472.
3. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E 84.

C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.

B. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

C. Vacuum clean surfaces.

D. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

E. Close floor openings.

F. Expansion Joints: Allow joints to continue through underlayment at the same width.

3.3 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.

1. Pump, move, and screed while the material is still highly flowable.
2. Be careful not to create cold joints.
3. Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

D. Place to thickness indicated. Spread and screed to a smooth surface.

E. For final thickness over 1-1/2 inches, place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.

F. Except at authorized joints, place continuously until application is complete so that no slurry is placed against underlayment product that has obtained its initial set.

G. Place before partition installation.

H. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

I. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.4 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

C. Drying: Provide continuous ventilation (mechanical if necessary to meet these standards) and adequate heat to rapidly remove moisture from the area until the underlayment meets moisture content standards for floor materials specified in other sections.

D. Test underlayment for dryness as specified in related sections specifying floor finishes.

3.5 PREPARATION FOR INSTALLATION OF GLUED FLOORING

A. Sealing: Seal all areas that receive glue down floor goods with manufacturer's recommended spray sealer. All floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering to be used. Where floor goods products specified in other sections require special adhesive or installation systems, those requirements supersede these recommendations.

B. Flooring Installation Procedures: Provide underlayment manufacturer's brochure of guidelines for installing finished floor materials for use in installation of products specified in other sections.

3.6 APPLICATION TOLERANCE

A. Top Surface: Level to 1/16 inch in 10 ft.

3.7 FIELD QUALITY CONTROL

A. An independent testing agency will perform field inspection and testing, as specified in Division 01 for Quality Requirements.

B. Slump Test: Test mix for slump during placement using a 2 inch by 4 inch cylinder resulting in a patty size of 8 inches plus or minus 1 inch in diameter.

C. Field Samples: At least one set of 3 molded cube samples shall be taken from each day's pour during the application. Cubes shall be tested as recommended by the manufacturer in accordance with modified ASTM C 472.

D. Placed Material: Agency will inspect and test for conformance to specification requirements.

3.8 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces. Protect from wheeled or concentrated loads with durable wood planks or as otherwise recommended by the manufacturer.

END OF SECTION

SECTION 04 22 00
CONCRETE MASONRY UNIT

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following: Concrete masonry units, reinforcement, anchorage and accessories.

B. Comply fully with the current edition of the California Building Code, Chapter 21A.

1.2 RELATED SECTIONS:

A. 32 13 13 - SITE CONCRETE IMPROVEMENTS

B. 32 13 15 - CONCRETE REINFORCEMENT

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

1.3 DEFINITIONS

A. CBC- The most current edition of the California Building Code.

1.4 REFERENCE STANDARDS

A. ACI 315 - Details and Detailing of Concrete Reinforcing.

B. TMS 402/602 - Specifications for Masonry Structures.

C. ASTM International:

1. ASTM C90 - Standard Specification of Hollow Load-Bearing Concrete Masonry Units.

2. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

3. ASTM C144 - Specification for Aggregate for Masonry Mortar.

4. ASTM C207 - Specification for Hydrated Lime for Masonry Purposes.

5. ASTM C404 - Specification for Aggregates for Masonry Grout.

6. ASTM C270 - Specification for Mortar for Unit Masonry.

7. ASTM C476 - Specification for Grout for Masonry.

8. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

9. ASTM C1019 - Standard Test Method for Sampling and Testing Grout

10. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry

11. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms

12. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

13. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.

14. ASTM E119 - Standard Test Method for Fire Tests of Building Construction and Materials.

15. ASTM E514 - Standard Test Method for Water Penetration through Masonry.

D. ICC – ESR Evaluation Service Reports:

1. ESR-1385 – Hilti Kwik Bolt 3 Masonry Anchors.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops a minimum installed compressive strength (f'm) of 1,500 psi.

B. For concrete unit masonry: As indicated on drawings.

1.6 SYSTEM DESCRIPTION - INTEGRAL WATER REPELLENT

A. The system of Integral Water-Repellent Admixtures for Block and Mortar is comprised of liquid polymeric admixtures; one mixed throughout the concrete during manufacture of the concrete masonry unit (CMU), the other added to the mortar during mixing. During the curing process and subsequent drying, the polymers cross-link becoming permanently locked in the units and in the mortar for long-lasting resistance to water penetration.

1.7 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01

B. Product data for each different masonry unit, accessory and other manufactured product indicated.

C. Shop drawings for reinforcing detailing fabrication, bending and placement of unit masonry reinforcing bars. Comply with ACI 315 “Details and Detailing of Concrete Reinforcing” showing bar schedules, stirrup spacing, diagrams of bent bars and arrangement of masonry reinforcement.

D. Material certificates for the following signed by the manufacturer and Contractor certifying that each material complies with requirements.

1. Each material and grade indicated for reinforcing bars.

2. Each type and size of anchors, ties and metal accessories.

E. Material test reports from a qualified independent testing laboratory indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated. Comply with CBC, section 2105A.

1. Mortar complying with property requirements of ASTM C 270.

2. Grout mixes. Include description of type and proportions of grout ingredients.

3. Masonry units.

F. Cold-weather construction procedures evidencing compliance with requirements specified in ACI 530.1/ASCE 6-13.

G. Hot-weather construction procedures evidencing compliance with requirements specified in ACI 530.1/ASCE 6-13.

H. Water Permeance Site Test Kit: Provide a Wall Spray Test Kit for site testing of water permeance of erected CMU mock-up panel.

1.8 QUALITY ASSURANCE

A. Unit Masonry Standard: Comply with the CBC, Chapter 2103A and ACI 530.1/ASCE 6-13.

B. Special Inspection: All masonry work shall be subject to special inspections in conformance with the current edition of the CBC, Chapter 17A. Inspections shall be as determined by Owners Inspection Laboratory.

C. Inspecting Laboratory Qualifications: To qualify for employment in performing tests and inspection specified in this Section, an independent testing laboratory must demonstrate to the Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying the progress of the work.

D. Preconstruction Testing: Owner will employ and pay a qualified independent testing laboratory to perform the following preconstruction testing indicated as well as other

inspecting and testing services required by referenced unit masonry standard or indicated herein for source and field quality control:

1. Concrete Masonry Unit Tests: For each different concrete masonry unit indicated, units will be tested for strength, absorption and moisture content per ASTM C 140.

2. Prism Tests: For each type of wall construction indicated, masonry prisms will be tested per CBC, Section 2105A.2.2.2 and ASTM C1314.

3. Mortar properties will be tested per property specification of ASTM C 270 and CBC Section 2105A.2.2.1.4.

4. Mortar composition and properties will be evaluated per ASTM C 780 and CBC, Chapter 2103A.

5. Grout compressive strength will be tested per ASTM C 1019.

E. Fire Performance Characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to the Engineer.

F. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

G. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion and other causes. If units become wet, do not place until units are in an air-dried condition.

C. Store cementitious materials off the ground, under cover and in a dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During erection, cover tops of walls and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar and soil that comes in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

2. Protect sills, ledges and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

C. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:

1. Do not lay masonry units that are wet or frozen.

2. Remove masonry damaged by freezing conditions.

D. Hot-Weather Construction: Comply with referenced unit masonry standard.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Basalite; www.basalite.com

2. Calstone Company; www.calstone.com

B. General: Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

2.2 CONCRETE MASONRY UNITS

A. General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.

1. Provide special shapes where indicated and as follows:

a. For lintels, corners, chase wall intersection, jambs, sash, control joints, headers, bonding and other special conditions. Provide side opening on units at wall corners and intersection to facilitate flow of grout.

2. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.

a. Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths.

b. Size: Standard units with nominal face dimensions of 16" long x 8" high. For width refer to the drawings.

c. Use full size units, without cutting ,where possible.

3. Provide Type I, moisture-controlled units.

4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

B. Wall Concrete Masonry Unit Type:

1. Surface texture: Match texture of existing wall units.

2. Color: Match color of existing wall units.

C. Hollow Load-Bearing Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:

a. 1,900 psi per ASTM C90, Table 2.

b. Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.

2. Weight Classification: Lightweight.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: As specified for concrete. Provide natural color or white cement as required to produce required mortar color.

B. Hydrated Lime: ASTM C 207, Type S.

C. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.

D. Aggregate for Grout: ASTM C 404.

E. Water: Clean and potable.

F. Grout color to match grout in existing walls.

2.4 REINFORCING STEEL

A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.

B. Steel Reinforcing Bars: Comply with ASTM A 615, Grade 60.

2.5 POST-INSTALLED ANCHORS

A. Use Hilti Kwik Bolt 3 concrete and masonry anchors (ESR-1385) or other anchors with valid ICC ES reports subject to the Structural Engineer's approval.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall, size and configuration as indicated.

1. Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.

B. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.7 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, or other admixtures, unless approved by the enforcement agency.

1. Do not use calcium chloride in mortar or grout.

2. Do not use antifreeze compounds.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar.

1. Limit cementitious materials in mortar to portland cement-lime.

C. For reinforced masonry, use Type S.

D. Grout for unit Masonry: Comply with ASTM C 476, and CBC, Section 2103A.12.

2.8 ADMIXTURES

A. Integral Water Repellent Admixture:

1. Description: An integral liquid polymeric admixture mixed with concrete during production of CMU which cross links and becomes permanently locked into the CMU, bond beam, or CMU lintel to provide resistance to water penetration to achieve a Class E Rating when tested in accordance with ASTM E514.

2. Product: “Dry Block”® integral water repellent admixture by Grace Construction Products.

B. Mortar Admixture:

1. Description: An integral liquid polymeric admixture designed specifically for use in a mortar mix, which cross links and becomes permanently locked into the mortar to provide resistance to water penetration, achieving a Class E Rating when tested in accordance with ASTM E514.

2. Product: “Dry Block”® integral water repellent admixture by Grace Construction Products.

2.9 SOURCE QUALITY CONTROL

A. Concrete Masonry Unit Tests: For each type, class and grade of concrete masonry unit indicated, units will be tested by qualified independent testing laboratory for strength, absorption and moisture content per ASTM C 140.

2.10 SEALER

A. Sealer for masonry work shall be a clear silicone water repellent. Apply two coats of sealer to CMU wall surfaces. Prepare all surfaces as recommended by the manufacturer. Material shall be installed per all manufacturer recommendations and requirements.

PART 3 EXECUTION

3.1 GENERAL

A. Low lift grouted construction shall be in accordance with CBC, Section 2104.5.1.2.2.

B. High lift grouted construction shall be in accordance with CBC, Section 2104.5.1.2.3.

3.2 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions and other conditions affecting performance of unit masonry.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.

B. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

3.4 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances of referenced unit masonry standard, and as follows:

1. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.5 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patters with uniform joint widths and for accurate locating of openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and where possible at other locations.

B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

D. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

1. Built-In Work: As construction progresses, built-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

2. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

3. Where built-in items are to embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

4. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

3.6 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

3.7 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Temporarily support formed-in-place lintels. Use specially formed bond beam units with reinforcement bars placed as indicated and filled with course grout.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 INSTALLATION OF REINFORCED UNIT MASONRY

A. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage or mortar and grout. Brace, tie and support forms to maintain position and shape during construction and curing of reinforced masonry.

B. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

C. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.9 FIELD QUALITY CONTROL

A. For quality assurance and testing, comply with CBC, Section 2105A.

B. Testing Frequency: Tests and evaluations listed in this article will be performed during construction for each 5,000 sq. ft. of wall area or portion thereof.

1. Mortar properties will be tested per property specification of ASTM C 270.

2. Mortar composition and properties will be evaluated per ASTM C 780 and CBC, Chapter 2103A.

3. Grout compressive strength will be sampled and tested per ASTM C 1019.

4. Core testing shall be per CBC 2010, Section 2105A.4.

C. Prism Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM C1314, Method B.

D. Evaluation of Quality Control Tests: In absence of other indications of non-compliance with requirements, masonry will be considered satisfactory if results from construction quality control test comply with minimum requirements indicated.

3.10 REPAIRING, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained or otherwise damaged or if units to not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water prior to application of cleaners promptly by rinsing thoroughly with clear water.

D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 051200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural-steel materials.
   2. Shrinkage-resistant grout.
   3. Shear stud connectors.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Structural-steel materials.
   2. High-strength, bolt-nut-washer assemblies.
   3. Shear stud connectors.
   4. Anchor rods.
   5. Threaded rods.
   6. Shop primer.
   7. Galvanized-steel primer.
   8. Galvanized repair paint.
   9. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment Drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
   5. Identify members not to be shop primed.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing including the following:
   1. Power source (constant current or constant voltage).
   2. Electrode manufacturer and trade name, for demand-critical welds.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For the following:
   1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
   2. Tension-control, high-strength, bolt-nut-washer assemblies.
   3. Shear stud connectors.

B. Survey of existing conditions.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:
   1. ANSI/AISC 303.
   2. ANSI/AISC 341.
   3. ANSI/AISC 360.
   4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
   1. Option 1: Connection designs have been completed and connections indicated on the Drawings.

C. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992

B. Channels, Angles, M-Shapes: ASTM A36 UNO.

C. Plate and Bar: ASTM A36, unless noted otherwise.

D. Cold-Formed Hollow Structural Sections: ASTM A500 Grade B structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
   1. Weight Class: Standard.
   2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts with plain finish.
   1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
   1. Finish: Plain.

C. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.
   1. Configuration: Straight.
   2. Nuts: ASTM A563 hex carbon steel.
   3. Plate Washers: ASTM A36/A36M carbon steel.
   4. Washers: ASTM F436, Type 1, hardened carbon steel.
   5. Finish: Plain.

B. Threaded Rods: ASTM A36/A36M.
   1. Nuts: ASTM A63 hex carbon steel.
   2. Washers: ASTM A36/A36M carbon steel.
   3. Finish: Plain.

2.5 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
   1. Joint Type: Snug tightened unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
   3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

      Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

END OF SECTION

SECTION 053100
METAL DECKING

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

PART 2 - PRODUCTS

2.1 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide product as noted on the plans from one of the following manufacturers:

1. Epic Metals Corp.

2. Nucor, North America

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 G60
   2. Deck Profile: As indicated.
   3. Profile Depth: As indicated.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
   6. Span Condition: As indicated.
   7. Side Laps: Interlocking seam.

2.2 ACOUSTICAL ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide product as noted on the plans:
   1. Epic Metals Corp.

B. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 G60 zinc coating.
   2. Deck Profile: As indicated.

3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
6. Span Condition: As indicated.
7. Side Laps: Interlocking seam.
8. Acoustical Perforations: Deck units with manufacturer's standard perforations
9. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.
10. Acoustical Performance: NRC 0.65, tested according to ASTM C 423.

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

ASC Profiles, Inc.
Nucor Corp.
Verco Decking, Inc., a Nucor company.
Or Equal.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
Profile Depth: As indicated
Design Uncoated-Steel Thickness: As indicated.
Span Condition: As indicated.

SCHEDULE 1 - ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
B. Side-Lap Fasteners: Mechanically fastened per plans
C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
E. Galvanizing Repair Paint: ASTM A 780 or SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

C. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
D. Install temporary shoring before placing deck panels if required to meet deflection limitations.
E. Locate deck bundles to prevent overloading of supporting members.
F. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members as indicated on the plans.
B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated on drawings.
C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches.
D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions.
E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.
F. Sound-Absorbing Insulation: Installation into topside ribs of acoustical roof deck as specified in Section.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Retain one weld diameter from "Weld Diameter" Subparagraph below or revise to suit Project.
2. Weld Diameter: 3/4 inch, nominal.
3. Retain one of two "Weld Spacing" subparagraphs below. First subparagraph is based on SDI specifications. Retain second subparagraph if showing requirements on Drawings.
4. Weld Spacing: As indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped or Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

PART 4 - FIELD QUALITY CONTROL

A. Testing Agency: The District will engage a qualified testing agency to perform tests and inspections.
B. Remove and replace work that does not comply with specified requirements.
C. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

PART 5 - PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 054000
COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior and exterior wall framing using Cold Formed Metal Framing.

B. Formed steel accessories.

1.2 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. AISI - American Iron and Steel Institute
1. S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
2. S200 - Cold-Formed Steel Framing.
3. S211 - Wall-Stud Design
4. S212 - Header Design
5. S213 - Lateral Design
6. S240 - North American Standard for Cold-Formed Steel Structural Framing.

C. ASTM International
1. A 1003 - Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
2. A653/A653M - Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy - Coated (Galvannealed) by the Hot-Dip Process.
3. C955 - Cold-Formed Steel Structural Framing Members.
4. C1007 - Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
5. C 1513 - Steel Tapping Screws for Cold-Formed Steel Framing Connections.

D. AWS D1.3 - American Welding Society, Structural Welding Code, Sheet Steel.

E. CBC California Building Code 2022, Chapter 22A

1.3 SUBMITTALS

A. Provide product data on standard framing members. Describe materials and finish, product criteria, limitations and properties.

B. Mill certificates: signed by the steel sheet producer indicating steel sheet complies with requirements.

C. Submit Special Environmental Product Submittal Form, found in Appendix A of Section 01 35 43, Special Environmental Requirements. Provide the following information for all metal stud framing materials:

1. Recycled Content.
2. Local/Regional Materials.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Current member of SFIA and/or SSMA. Company specializing in steel studs framing and components and regularly and continuously engaged in the manufacturing of non-structural metal framing members for not less than five (5) years.
   1. SSMA: Steel Stud Manufacturers Associations, ICC ESR-3064P
   2. ClarkDietrich Building Systems, ICC ESR-1166P
   3. Cemco California Expanded Metal Products Company, ICC ESR-3016

B. Welding: welders certified by AWS.

C. Recycled Content:
   1. SABRC (State Agency Buy Recycled Campaign) Standards: Provide recycled content minimums for all steel derived products as described by CIWMB. (Refer to the following website for updated recycled content percentages: http://www.ciwmb.ca.gov/BuyRecycled/StateAgency).
   2. Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines Buy-Recycled Series: Construction Products, 2004.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI's "Code of Standard Practice".

PART 2 - PRODUCTS

2.1 FRAMING MATERIALS

A. Framing Members, General: Comply with ASTM C 955 for conditions indicated.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grading and coating designation as follows:
   1. Grade: as required by structural performance.
   2. Coating: CP60, G60 (Z180), A60 (ZF180), AZ50 (AZM 150), or GF30 (ZGF90).

C. Steel Sheet for [Vertical Deflection] [Drift] Clips: ASTM A 1003 /A 1003M, ASTM A 653/A 653M, structural steel, zince coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 (Z275).

D. Studs: ASTM A1003, Structural Grade 50, Type H (ST50H), sheet steel, formed to "wide flange" shape or "C" shape, punched web, 16 gauge (0.0538") thick unless noted otherwise on drawings, 50 ksi steel unless noted otherwise on drawings, sizes required to conform to details and scheduled wall thicknesses, and as required for structural

performance. Studs shall be rolled from new sheet steel and shall not be produced from re-rolled steel.

1. Properties: As listed in manufacturer's standard tables for applicable grade of steel and sizes.
2. Conform to AISI S100 and AISI S200.
3. Coating: Zinc coated per ASTM A653, G60 [Prime painted, minimum thickness of 1 mil all surfaces including edges].

E. Track: ASTM A1003, Structural Grade 50, Type H, sheet steel, channel shaped, deep leg, 16 gauge (0.0538") thick unless noted otherwise on drawings, 50 ksi steel unless noted otherwise on drawings, solid web, long leg at ceilings, profile to produce snug fit over adjacent components.

1. Conform to aisi S100 - Design of Cold-Formed Steel Structural Members.
2. Approved pre-fabricated slotted slip track for top of wall: CEMCO Slotted Track (CST) 16 gauge, ICC ESR-2012 or equal as approved in accordance with Division 01, General Requirements for substitutions.
3. Provide stand-off washers for fasteners.
4. Install in accordance with manufacturer’s recommendations and fire rating requirements.
5. Coating: Zinc coated per ASTM A653, G60

2.2 ACCESSORIES

A. Fastening: Self-drilling, Self-tapping Screws, ASTM C954, galvanized, Buildex / Tomarco Type S-12 point, low profile head screws #10 or equal, 1/2 inch long for two layers 16 gauge metal for non load-bearing framing, welded connections for load-bearing framing and for framing of 16 gauge studs and thicker.

B. Welding: In conformance with AWS D1.3, minimum weld size 3/32".

2.3 FINISHES

A. Galvanized Finish: Zinc coated per ASTM A653, G60.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrate surfaces and building framing components are ready to receive work.

B. Beginning of installation means acceptance of existing conditions.

C. Layout markings shall not be made with xylene-based inks, paint, or dyes, or with other solvent-based products that may bleed through finishes.

3.2 ERECTION OF STUDDING

A. Install cold-formed steel framing in accordance with ASTM C 1007 and AISI S240 "North American Standard for Cold-Formed Steel Framing - General Provisions", and manufacturer's written instructions unless more stringent requirements are indicated.

B. Align floor and ceiling tracks; locate to wall or partition layout. Secure in place with specified fasteners at spacing as indicated on drawings or maximum 32 inches on centers.
   1. Set floor track on continuous sealant, each side of track for exterior walls. Sealant type: Butyl Rubber per ASTM C920.
   2. Track Splices: notch flanges to allow sliding tracks past each another 12". Attach as approved by manufacturer of system.

C. Place studs at 16 inches oc typically, or 12 inches oc in plumbing walls or as noted on drawings. Connect studs to tracks using fastener or welding method.

D. No flame (oxyacetylene) torch cutting is permitted, use Plasma Arc cutting to make penetrations for conduit or piping where required.

E. Construct corners using minimum three studs.

F. Install double (boxed) studs at each head, jamb and sill of each exterior and interior door and window opening. Extend studs from floor to underside of structure above. Weld all boxed jamb and header members with interrupted 1/8" welds, one inch long at 12 inches on center.

G. Install 1-1/2 inch standard steel furring channels at right angles to king stud at each door hinge point as permitted by perforations. Weld channel to four studs where possible.

H. Erect studs one piece full length. Splicing of studs is not permitted, except where detailed.
   1. Where studs have been cut to receive piping conduits and equipment, weld on two 3/4 inch furring channels to restore stability of weakened stud.

I. Extend stud framing through ceiling to underside of floor or roof structure above unless detailed otherwise.

J. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

K. Install intermediate studs above and below openings to match wall stud spacing.

L. Provide deflection allowance of 1/2 inch minimum in stud track (or as indicated on the drawings), directly below horizontal building framing for non-load bearing framing.

3.3 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes, with stiffened flanges, with size and gauge as indicated on the drawings.
   1. Flange Width: as noted on structural drawings.
   2. Install per drawings and conform to SFIA / SSMA.

3.4 TOLERANCES

A. Maximum Variation from True Position: 1/8 inch in 10 feet.

B. Maximum Variation of any Member from Plane: 1/8 inch.

3.5 CLEANING

A. Clean substrate; remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect final floor finish appearance or performance.

3.6 QUALITY CONTROL

A. Inspection of all field-welding operations shall be performed by qualified and certified Welding Inspector approved by the Structural Engineer and DSA.

B. Welding Inspector shall check materials, equipment, procedures, welds and certification of welders. Furnish the Owner with reports verified by the Inspector that welding has been performed in accordance with the Contract Documents.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All miscellaneous metal fabrications not classified as structural steel.

B. Inserts and anchorages: Furnish only, inserts and anchoring devices for installation of miscellaneous metal work. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work.

C. Miscellaneous nonferrous metal items not specified under other sections.

D. Fabrication and installation of metal work, including shop and field welding, drilling, cutting, connecting and shop painting.

E. Miscellaneous shapes, plates, angles, clip angles, supports, bolts, and specialty iron and steel items indicated and as necessary to complete the work, including, but not limited to, the following:
   1. Metal handrails, railings, and guardrails.
   2. Perforated metal panels at guardrails.
   3. Cane detection railing beneath stairs.
   4. Pipe sleeves.
   5. Steel pipe rain water leaders and brackets.
   6. Roof ladders, mounting plates, brackets, and fasteners.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 05 1200 - Structural Steel.

C. Section 07 4113 - Metal Roof Panels

D. Section 08 9100 - Louvers

E. Section 09 9113 - Exterior Painting

F. Other sections requiring metal fabrications or referencing this section for fabrication and installation.

G. Pertinent Division 22, 23 and 26 sections: Sleeves and inserts for mechanical piping and ducts, and electrical conduit, bracing and support of mechanical and electrical equipment.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM E 935 - Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

C. AHDGA - American Hot Dip Galvanizing Association.

D. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel.

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.

G. SSPC (PM2) - Painting Manual, Vol. 2, Systems and Specifications; Steel Structures Painting Council.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Include details of cuts, connections, camber, holes, and other pertinent data.
   2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths, sizes and types.

C. Product Data:
   1. Catalog cuts for all manufactured items demonstrating compliance with specified requirements.
   2. Structural steel primer paint.

1.05 SUBMITTALS FOR RECORD

A. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.06 QUALITY ASSURANCE

A. Design criteria: Design, fabricate and erect miscellaneous metal items complete, in accord with AISC's Design, Fabrication and Erection of Structural Steel for Buildings.

B. Coordinate the Work under provisions of pertinent sections of Division 01.

C. Welders:
   1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
   2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months, and are qualified in the State of California.

D. Welding Inspection: All structural welding shall be specially inspected according to CBC 1704A and DSA IR-17-3 except as otherwise provided below.
   1. Special inspection shall not be required if welding is done in an approved fabricator’s shop licensed in accordance with CBC 1704A.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Furnish new tested stock complying with reference specifications.

B. Steel Sections: ASTM A36/A36M.

C. Steel Tubing: Hot formed, welded or seamless, ASTM A 501, or cold-formed, ASTM A500, Grade B cold-formed.

D. Plates: ASTM A283/A283M.

E. Pipe: ASTM A53/A53M, Grade B Schedule 40, hot-dip galvanized finish.

F. Bars and bar-size shapes: ASTM A 663, Grade 65, or ASTM A 36.

G. Hot-rolled carbon steel bars and bar-size shapes: ASTM A 575, Grade as selected by fabricator.

H. Carbon steel sheets and strips:
   1. Hot-rolled: ASTM A 568 and ASTM A 569, pickled and oiled.
   2. Cold-rolled: ASTM A 366.

3. Galvanized sheets: ASTM A 525, or A 526 with G-90 zinc coating

I. Fasteners: Select fasteners for type, grade and class required for the installation of miscellaneous metal items, compatible for material in contact. Provide hot-dipped galvanized at exterior exposures or when in contact with pressure-treated wood materials..

J. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
1. Standard bolts and nuts: Regular square or hexagon head type, ASTM A 307, Grade A.
2. Lag bolts: Square head type, galvanized.
3. Machine screws: Cadmium-plated steel, ASTM F 468 and FS FF-S-92.
4. Plain washers: ANSI B18.22.1 and FS FF-W-92.
5. Anchors: Manufactured by Ramset Fastening System Division, Olin Corp., Rawlplug Co., Diamond Division, General Cable, Hilti or ITT Phillips Drill Division. Provide type best suited for intended application and indicate on shop drawings.
6. Lock washers: FS FF-W-84, helical spring type carbon steel.
7. Anchor Bolts: ASTM A307.

K. Brackets, flanges and anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

L. Concrete inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A 47 or cast steel ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

M. Welding Materials: AWS D1.1; type required for materials being welded. Comply with AWS D1.1, D1.3 and CBC Title 24 Part 2.

N. Non-shrink grout for can detection railings and handrail inserts: Masterflow 928 Grout by Master Builders or equal.

O. Zinc-rich paint (cold galvanizing): ZRC-221 by ZRC WorldWide, or equal.

P. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction, compatible with intermediate and finish coatings specified in other Sections.

Q. Touch-Up Primer for Galvanized Surfaces: ZRC Zero-VOC by ZRC Wordwide, or equal, compatible with intermediate and finish coatings specified in other Sections

2.02 FABRICATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. Allow for trimming and fitting where field conditions preclude accurate measurements or where final dimensions cannot be established prior to fabrication.

B. Fit and shop assemble items in largest practical sections, for delivery to site.
1. Minimize field splicing and site assembly. Disassemble only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
2. Complete assembly, including welding, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.
3. Use materials and items necessary to complete the work, using the best materials and methods ordinarily used for this type of work whether explicitly specified, indicated and detailed or not.

C. Fabricate items with joints tightly fitted and secured.

D. Continuously seal joined members by continuous welds.
1. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
3. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Use only materials smooth and free of blemishes including pitting, seam marks, roller marks, trade names and roughness.

F. Fabricate steel members in accordance with drawings and as recommended by A.I.S.C. Verify all dimensions with field conditions prior to fabrication.
1. Clean, prepare and shop-prime steel members. Do not prime surfaces to be field welded or in direct contact with concrete.
2. Galvanizing: ASTM A153, ASTM A123; all steel exposed to weather.
3. Cutting and drilling: Provide holes for fabrication and for attachment of work specified elsewhere. Countersink holes for bolts and screws.

G. Welding: Comply with the AWS Structural Welding Code, and with the following:
1. Welds shall be free from excessive oxides, nonmetallic inclusions, and gas pockets.
2. Welds shall be uniform in section, smooth in weld metal, feather edged, without overlaps.
3. Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter.
4. Tack welds located in way of design welds shall be melted out when encountered in final welding, or shall be thoroughly fused in with final weld.
5. Use proper care and procedures to minimize locked-in stress and distortion.
6. Welder qualification requirements, welding procedure and welding electrodes shall conform to CBC 2204A and most recent editions of AWS D1.1, D1.3; CBC IR-17-3.

2.03 GUARDRAILS, HANDRAILS and RAILINGS

A. Steel pipe or tube guardrails, handrails and railings: Fabricate to dimensions and details shown, with welded joints ground smooth and flush. powder coated at exterior locations.
1. Fabricate and install to comply with requirements of ASTM E985 for structural performance based on testing performed in accordance with ASTM E894 and E935.
2. Structural Performance: Handrails and top rails shall withstand the following structural loads:
   a. Concentrated Load: 200 lbs., applied non-concurrently, in any direction.
   b. Uniform Load:50 lb/ft. applied simultaneously in both vertical and horizontal direction.
   c. Concentrated loads and uniform loads need not be assumed to act concurrently.
3. Shop fabricate to greatest extent possible.
4. Interconnect railing members by butt-welding or by welding with internal connectors, unless otherwise indicated.
5. At tee and cross intersections, notch ends of intersection members to fit contour of pipe and weld all around.
6. Form changes in direction of railing members by radius bends, maintaining cylindrical cross-section of pipe throughout bend without buckling, twisting, cracking or otherwise deforming exposed surface of pipe.
7. Provide galvanized inserts for concrete paving for attachment of rails, where occurs.

2.04 STEEL PIPE RAIN WATER LEADERS (RWL)

A. Steel pipe or tube rain water leaders: Fabricate to dimensions and details shown, with welded joints ground smooth and flush, hot-dipped galvanized.
1. Structural Performance: Rain water leaders shall withstand the following structural loads:
   a. Concentrated Load: 200 lbs., applied non-concurrently, in any direction.
   b. Uniform Load:50 lb/ft. applied simultaneously in both vertical and horizontal direction.
   c. Concentrated loads and uniform loads need not be assumed to act concurrently.
2. Shop fabricate to greatest extent possible.

3. Interconnect rainwater leader members by butt-welding or by welding with internal connectors, unless otherwise indicated.
4. At intersections and changes of direction, notch ends of intersection members to fit contour of pipe and weld all around. Seal weld all joints water-tight.
5. Form changes in direction of water flow by mitered connections, maintaining cylindrical cross-section of pipe throughout bend without buckling, twisting, cracking or otherwise deforming exposed surface of pipe.
6. Provide support brackets of sizes and types indicated and with configurations required to suit substrates and framing spacing.

2.05 PERFORATED METAL

A. Perforated Metal as manufactured by McNichols Co., Hayward CA, or equal: Locations and sizes as indicated.
   1. 12 gauge stainless steel.
   2. Perforation size, shape, arrangement: Holes, 1/2” diameter, stagger centers at 11/16" 48% open area.
   3. Blank margin 2” wide on 4 sides of panel

2.06 FINISHES - STEEL

A. Guardrails, Handrails, and railings to be powder coated. Color as selected by Architect.

B. Rain Water Leaders to be prime painted for field painting.

C. Cane detection railings beneath stairs to be hot-dipped galvanized.

2.07 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work. Correct conditions detrimental to the proper and timely performance of this work before proceeding with installation. Commencement of work indicates acceptance of substrates.

3.02 PREPARATION

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

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, measured from established lines and levels, accurately fitted, free from distortion or defects.

B. Provide temporary bracing or anchors in formwork for items which are to be built into concrete or similar construction.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction; including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

D. Cutting and fitting:
   1. Perform cutting, drilling and fitting required for installation of miscellaneous metal items. Fit exposed connections accurately together to form tight hairline joints.
   2. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
   3. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field weld components as indicated on drawings or as required to assemble shop-fabricated work on site. If field-welding is not specifically indicated on drawings, option is the Contractor's for efficient assembly.

F. Perform field welding in accordance with AWS D1.1/D1.1M.

G. Obtain approval prior to site cutting or making adjustments not scheduled.

H. Immediately after erection, clean and prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete with the same materials used for shop finishing.

I. Steel Pipe or Tube Fences and Railings: Plumb posts in each direction.
   1. Anchor posts in concrete by means of galvanized steel pipe sleeves, not less than 6" long, with an outside diameter not less than 1/2" greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to bottom of sleeve of width and length not less than 1" greater than outside diameter of sleeve. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-ferrous grout.
   2. Anchor rail ends into masonry with steel round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
   3. Secure handrails to walls using wall brackets, and wall return fittings at handrail ends. Provide brackets with not less than 3" projection from finish wall surface to center of pipe handrail, and with wall plate portion of bracket drilled to receive one 3/8" bolt. Locate brackets at not more than 5 ft. o.c. Provide flush-type wall return fittings with same projection as that specified for wall brackets. Secure brackets and return fittings as follows:
      a. Wood framing: Use lag screws.
      b. Steel Framing: Stainless steel threaded self- tapping screws.
      c. Masonry or Concrete: Stainless steel threaded tap-in anchor bolts.

J. Rainwater Leader Installation: Plumb units in each direction.
   1. Accurately locate rainwater leaders in proximity to underground storm drain connections. Coordinate with work of other sections for accurate placement and alignment of the work.
   2. Secure Rainwater Leaders to walls using wall brackets. Secure brackets and return fittings as follows:
      a. Steel Framing: Stainless steel threaded self- tapping screws.
      b. Structural Steel column or member: Weld.
   3. Locate supporting brackets at approximately equal intervals, not less than 5'-4" on center, not less than 18 inches from ends, with a minimum of three per supports per unit, and additional brackets within 18 inches of change in direction or substrate mounting material.
   4. Connect rain water leaders to storm drains with water-tight connection.

3.04 TOLERANCES

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

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 PROTECTION

A. Protect finished work from damage until acceptance by Owner.

B. Repair and replacement: In the event of damage, immediately make repairs and replacements necessary to satisfaction of Architect without change in contract sum or time.

3.06 CLEAN-UP

A. When work of this section has been completed, and at such other times as may be directed, remove all trash, debris, surplus materials, tools and equipment from site.

B. Comply with pertinent requirements of Division 01 section specifying Contract Closeout.

END OF SECTION

SECTION 055105
ALUMINUM LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum access ladders.

1.2 RELATED SECTIONS

A. Section 055000 – Metal Fabrications: Fasteners and installation requirements used to attach ladders to structure.

B. Section 142100 – Elevators: For pit ladders.

C. Section 260527 – Basic Electrical Materials and Methods: For electrical grounding of ladders.

1.3 REFERENCES

A. AA – Aluminum Association.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. OSHA 1910.27 – Fixed Ladders.

1.4 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Manufacturer's data sheets on each product.

C. Shop Drawings:

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.

2. Provide templates for anchors and bolts specified for installation under other Sections.

3. Provide reaction loads for each hanger and bracket.

D. Qualification Data:

    1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.

F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

    1. Record of successful in-service performance.

    2. Sufficient production capacity to produce required units.

    3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

    1. Install ladder in area designated by Architect.

    2. Do not proceed with remaining work until workmanship and installation are approved by Architect.

    3. Rework mock-up as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.8 WARRANTY

A. A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.

2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.

3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.9 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: O’Keeffe’s, Inc.; 100 N Hill Drive, Suite 12, Brisbane, CA 94005. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web: http://www.okeeffes.com.

B. Requests for “OR EQUAL” substitutions will be considered in accordance with provisions of Section 012500.

2.2 APPLICATIONS/SCOPE

A. Fixed and Cage Ladder Design:

1. Safety cages are required on ladders over 20 feet (6096 mm)
2. Safety cages are required on all ladders in high or hazardous areas.
3. Landing platforms are required at 30 feet (9144 mm) above the bottom of the ladder.
4. Rail and harness fall arrest system as alternate to safety cage and landing platforms shall be a permissible manufacturer's option.
    a. Fixed Ladder Bottom Bracket:
    b. Bottom floor supported bracket.
    c. Bottom wall supported bracket.
    d. Bracket as drawn.

B. Fixed Access Ladder:

1. Tubular Rail Low Parapet Access Ladder with Platform.
    a. Model 503A as manufactured by O'Keeffe's Inc.

2.3 FINISHES

A. Mill finish. As extruded.

B. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

C. Paint. Urethane over chemically pretreated substrate.

1. Fire Red (RAL 2002).
2. Alert Orange (RAL 2003).
3. Warning Blue (RAL 5005).
4. Caution Yellow (RAL 1018).
5. Safety Green (RAL 6001).
6. As scheduled on drawings.

2.4 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.5 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

    1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Ship Ladders: Not less than 1-1/4 inches (32mm) high, 4-1/8 inch (105 mm) deep and 2 feet (610 mm) wide; tread spacing shall be 1 foot (305 mm) on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches (38 mm) in diameter with hemispheric end caps.

E. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

F. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.

G. Security Doors: Formed 1/8 inch (3 mm) thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches (51 mm) of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.

H. Ship Ladder Seismic Bottom Support: Manufacturer’s standard; two isolation bearings per stringer.

I. Ladder Safety Post: Retractable hand hold and tie off.

J. Rail and Harness Fall Arrest System: Supplied in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 061053
MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exposed plywood backing for utilities.
   2. Plywood underlayment at gypsum board.
   3. Miscellaneous blocking, backing, and nailers.
   4. Wood treatments.

B. Related Requirements:
   1. Self-Adhering Sheet Flashing (SAF): Section 07 65 00.
   2. Gypsum Sheathing: Section 06 16 43.
   3. Gypsum Board: Section 09 29 00; exterior wall sheathing.

1.02 REFERENCES

A. American Wood Protection Association (AWPA):
   1. U1, “User Specification for Treated Wood."
   2. T1, “Processing Treatment Standard.”

B. American Society for Testing and Materials (ASTM):
   1. E84, "Test Method for Surface Burning Characteristics of Building Materials."
   2. D2898, "Method for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."

C. Department of Commerce:
   1. US Product Standard PS 1, "Structural Plywood."
   2. US Product Standard PS 20, "American Softwood Lumber Standard."

D. West Coast Lumber Inspection Bureau (WCLIB): "Standard Grading and Dressing Rules No. 16."

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 33 00, “Submittal Procedures.”

1.04 ACTION SUBMITTALS

A. Product Data: Wood treatment certification and instructions for proper use of each type of treated material.
   1. Include 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.
   2. 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 a qualified independent testing agency.
   3. 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 D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
6. For composite wood products, provide documentation of no added urea formaldehyde.

1.05 QUALITY ASSURANCE

A. Lumber-grading rules and wood species shall conform to Product Standard PS 20 and "Standard Grading and Dressing Rules No. 16" of the West Coast Lumber Inspection Bureau (WCLIB).

B. Plywood shall conform to requirements of Product Standard PS 1.

C. Rough carpentry shall conform to applicable requirements of local building code and CBC, Chapter 25, unless otherwise noted.

D. Grade Marks:
1. Identify lumber and plywood by official grademark, or provide inspection certificates from appropriate grading and inspecting agencies.
2. Do not expose faces with grademarks.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Immediately upon delivery to jobsite, place materials in area protected from weather.

B. Protect lumber stored on site from rain and excessive sun. Stack in such fashion as to prevent twisting and warping.

C. Comply with additional requirements specified in Section 01 60 00, "Product Requirements."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber:
1. Dimensions:
   a. Specified lumber dimensions are nominal.
   b. Actual dimensions shall conform to industry standards established by the National Grading Rule Committee.
2. Moisture Content: Provide S-Dry seasoned lumber at time of permanent closing in of building for all framing, except, for lumber of 4 inch or greater nominal thickness, provide FOHC lumber.
3. Dressing: Lumber shall be dressed S4S, unless otherwise noted.
4. Species: Unless otherwise noted, framing lumber shall be Douglas Fir.
5. Grades: Following lumbers are specified in accordance with WCLIB grade designations.
   a. Backing and Furring: 2 inches to 4 inches thick x 2 inches to 4 inches wide, "Standard" or better grade, paragraph 122-b.

B. Plywood: Group 1 species complying with US Product Standard PS 1.
1. Veneer Grade at Exposed Utility Backing: B-D or B-C Exterior or Interior with exterior glue, five plies for 1/2 inch and thicker.
2. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness
   a. Plywood shall have no added urea formaldehyde.

C. Rough Hardware:
   1. Screws for attaching wood members and plywood to metal stud walls, partitions and furring shall be Type S self-drilling, self-tapping, anodized steel drywall screws of required lengths as specified in Section 09 29 00, "Gypsum Board."
   2. Hot-dip-galvanize items exposed to moisture or weather.

D. Fasteners:
   1. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
      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 A 153/A 153M.
   2. Nails, Brads, and Staples: ASTM F 1667.
   3. Power-Driven Fasteners: NES NER-272.
   4. Wood Screws: ASME B18.6.1.
   5. Lag Bolts: ASME B18.2.1.
   6. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
   7. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   8. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   9. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

2.02 WOOD PRODUCTS

A. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal (38-mm actual) thickness or less, and no limit for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.03 WOOD TREATMENTS

A. Wood-Preservative Pressure Treatment: In accordance with AWPA U1 and T1 Standards. Treat wood sills, sleepers, blocking, furring, stripping, and similar members in contact with concrete, built-up roofing, waterproofing, and flashing. Use system specifically formulated for either interior or exterior applicable to location of use.

B. Fire-Retardant Pressure Treatment:
   1. Fire-retardant-treated wood shall have an Underwriters' Laboratories stamp signifying a FR-S rating certifying a 25 or less flame-spread and smoke-developed value when tested in accordance with ASTM E84.
   2. Acceptable Fire-Retardant Pressure Treatment: “Dricon” by Lonza Wood Protection, or accepted equal.
   3. After treatment, kiln-dry lumber to maximum 15 percent moisture content.
   4. Locations of Use:
      a. All concealed lumber, and plywood except as otherwise specified, shall be fire retardant treated.
      b. Exposed back boards for electrical and telephone panels and other equipment shall

be fire retardant treated.

5. Where fire retardant treated wood is exposed to weather, it shall be identified as "Exterior" to indicate there is no increase in the listed flame spread index as defined in CBC Section 2303.2 when subjected to ASTM D2898.
6. Where fire retardant treated wood is exposed to humid interior conditions, it shall be identified as "Interior" to indicate that the treated wood has a moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92 percent relative humidity.

C. Field-Applied Fire-Retardant Treatment (If Required): Latex intumescent coating; “Insl-x” Fire Retardant Paint FR-110 by Benjamin Moore, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:
1. Work shall be accurately cut and solidly fitted together so as to provide strong, rigid joints, with full bearing for all members.
2. Surfaces shall be level, plumb, and true.
3. Provide accessories and install in accordance with manufacturer's specifications.

B. Blocking:
1. Provide and install wood blocking, plywood backing, furring strips, or grounds detailed or required to provide anchorage for finishes, accessories, fixtures, and similar items required to complete work.
2. Blocking and/or backing shall be securely bolted or otherwise anchored in place.

C. Plywood: Comply with recommendations of the APA for fabrication and installation of plywood work.
1. Lay with face grain perpendicular to supports.
2. Butt panel ends and edges to a close but not tight fit (allow 1/16-inch space).

3.02 FIELD APPLIED TREATMENTS

A. Wood Preservative, Exposed Interior or Exterior Wood or Plywood: Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground.

B. Fire-Retardant; Concealed Interior Wood and Plywood: Brush or spray-apply two coats of intumescent paint. Take care to prevent paint from showing on work to remain exposed.

C. Fire-Retardant; Exposed [Interior or] Exterior Wood or Plywood:
1. Spray-apply three coats of colorless coating to properly prepared substrate. If treatment causes grain rising, lightly sand and dust surface.
2. After coating has dried, spray-apply one coat of wax sealer.

D. Appearance of finished work shall match accepted sample.

END OF SECTION

SECTION 061643
GYPSUM SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-structural gypsum wall sheathing.
   2. Non-structural gypsum roof deck sheathing.
   3. Structural gypsum sheathing.

B. Related Requirements:
   1. Structural Metal Stud Framing: Section 05 40 00; structural gypsum sheathing.
   2. Insulated Metal Roofing: Section 07 41 13.
   3. Gypsum Board: Section 09 29 00.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

B. Coordination: Coordinate with Section 07 2117, “Thermal Board and Blanket Insulation,” as to requirements for roof sheathing.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data for each product.

1.04 INFORMATIONAL SUBMITTALS

A. Verification of calculations to determination of application rate of adhesive for this project based on FM 1-28 and FM 1-29.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Immediately upon delivery to jobsite, place materials in area protected from weather. Each bundle or package of sheathing shall bear the manufacturer’s name and/or trademark.

B. Comply with additional requirements specified in Section 01 60 00, "Product Requirements."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-Structural Gypsum Sheathing: ASTM C1396; US Gypsum, National Gypsum, or accepted equal.
   1. Grade: W, water-resistant treated core .
   2. Thickness: As indicated on the Drawings.

3. Style: Square edges and ends or "V" tongue-and-groove long edges, square ends.

B. Non-Structural Gypsum Wall Sheathing: ASTM C1177, fiberglass-faced, silicone-impregnated core; "Dens Glass" by Georgia Pacific, “Securerock” by United States Gypsum, or accepted equal.
   1. Thickness: 5/8 inch, unless otherwise shown.
   2. Size: 4 feet wide x maximum lengths possible; 8 feet minimum.
   3. Edge: Square.

C. Non-Structural Gypsum Roof Sheathing: Glass mat faced-faced, non-structural, silicone-treated core gypsum panel conforming to ASTM C1177; Georgia-Pacific "Dens-Deck Prime," or accepted equal.
   1. Classification: Meet UL Class A and FM Class 1.
   2. Thickness: 1/2 inch.
   3. Style: Square edges and ends.
   4. Size: 4 feet by 8 feet.

D. Non-Structural Gypsum Roof Sheathing: Glass mat faced, gypsum fiber roof board conforming to ASTM C1278 and ASTM C1177, and approved for use in the specified roofing system; "Securock Roof Board" by United States Gypsum, or accepted equal.

2.02 ACCESSORIES

A. Fasteners:
   1. Roof Sheathing: As recommended by manufacture for each substrate and as required by roofing system manufacturer for required UL and FM ratings and extended warranty.
   2. Wall Sheathing: Corrosion-resistant conforming to ASTM C954 and requirements of CBC Section 1403.3; USG “Sheathing Type [WF] [SF],” or equal.
      a. Length as recommended by manufacturer for board thickness and substrate.
      b. Provide Type specifically designed for attachment to heavy steel gage metal framing.

B. Adhesive: Single component polyurethane; Dow “INSTA STIK” Quik Set Commercial Roofing Adhesive,” or equal.

PART 3 - EXECUTION

3.01 INSTALLATION – NON-STRUCTURAL WALL SHEATHING

A. Install sheathing vertically or horizontally using specified fasteners in accordance with board manufacturer’s installation recommendations.

B. Fit boards tightly against each other and around openings.
   1. If applied vertically, edges shall be parallel to and centered over studs.
   2. Stagger end joints.

C. Provide back blocking or supplemental framing where recommended by board manufacturer and wherever end joints do not bear against framing.

D. Secure to framing using specified fasteners.
   1. Secure to supports in accordance with manufacturer's recommended spacing, but space fasteners not more than 4 inches on center around perimeter at edge and end supports and 8 inches on center at intermediate supports.
   2. Install flush with face of board; do not countersink.

3. Keep perimeter fasteners 3/8 inch from edges and ends of board units.

3.02 INSTALLATION – GYPSUM ROOF SHEATHING

A. Apply specified gypsum board panel over insulation with fasteners passing through insulation using FM approved fasteners.

B. Lay panels with joints staggered from joints in underlying insulation.

C. Provide fasteners in pattern in accordance with FM Class I-90 approval requirements.

3.03 GYPSUM WALL SHEATHING

A. Fasten to exterior face of stud framing for exterior walls in accordance with manufacturer's instructions, applicable instructions in GA-253 and ASTM C1280, and ICC ES Legacy Report NER-574.

A. General: Follow application instructions of adhesive manufacturer including ambient temperature at time of application.

B. Surfaces shall be free of debris, dirt, dust, grease, oil, standing water, and other contaminants. Remove residual shop oil coating is removed with TSP or other comparable cleaner.

C. Apply adhesive centered over upper flange of roof deck using automatic dispensing wands and equipment.

A. Install as shown and in accordance with the approved ICC-ES Report for installation over wood framing.

B. Long dimension parallel to stud framing.

C. Steel face shall be in contact with framing with panel edges fully blocked by framing studs that are doubled at shear wall ends.

END OF SECTION

SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Custom casework with wood veneer facing.
   2. Custom casework with plastic laminate facing.
   3. Finish hardware for casework.

B. Related Requirements:
   1. Resilient Flooring: Section 09 65 00; resilient base at cabinets.
   2. Tackboard: Section 10 11 00: Visual Display Boards.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A208.2: Medium Density Fiberboard for Interior Use.
   2. ANSI/BHMA A156.9: American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association.
   3. ANSI/BHMA A156.18: American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association.

B. Woodwork Institute (WI): “North American Architectural Woodwork Standards” (NAAWS) published jointly by WI and the Architectural Woodwork Manufacturers of Canada (AWMAC).

C. National Electrical Manufacturers Association (NEMA): NEMA LD3.1: "High-Pressure Decorative Laminates."

1.03 DEFINITIONS

A. Unless otherwise specified, exposed, semi-exposed, and concealed surfaces shall conform to the cabinet surface terminology in Section 10 - Casework of the referenced NAAWS publication.

1.04 ACTION SUBMITTALS

A. Shop Drawings:
   1. Drawn to scale dimensioned plans, elevations, component profiles, and large scale details for each casework item.
   2. Prepare in accordance with NAAWS, Section 1, “Submittals.”
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for plumbing fixtures and other items.
   5. Apply WI-certified compliance label to first page of Shop Drawings

B. Product Data:
   1. Cabinet hardware items.
   2. Shop-applied coatings.
   3. Provide documentation VOC content for adhesives.
   4. Provide documentation that wood panel products and bonding adhesives contain no urea formaldehyde.

C. Samples:

1. Panel with wood Veneer selected from and representative of veneer flitches to be used; complete with specified finish.
2. Plastic Laminate and Edge Banding: One sample, 8 by 10 inches, for each type, color, pattern, and surface finish with sample applied to core material and specified edge material applied to 1 edge.
3. Hardware: Items as requested by the Architect.

D. Sustainable Design
1. Submit information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.05 INFORMATIONAL SUBMITTALS

A. Certification: Before delivery of casework to jobsite, submit WI Certified Compliance Program certificates.

B. Fabricator qualifications.

1.06 QUALITY ASSURANCE

A. Qualifications: Firm specializing in quality architectural cabinetwork and active member of WI or AWI. Fabricators not active members of WI or AWI will be considered upon submission of verifiable evidence of experience in successful completion of work similar to work of this Project. This provision does not waive compliance with specified WI Certification.

B. Installer Qualifications: Installer shall be fabricator of plastic laminate casework or fabricator shall be responsible for the Work of the installer.

C. WI Certified Compliance Program:
1. Casework and the installation thereof for this Project shall be certified by Architect and Contractor for compliance to the Contract Documents:
2. Fees charged by WI to either WI licensee or non-licensee are the responsibility of the Architect and Contractor.
3. Casework and/or installation determined to be non-compliant by WI and not corrected will be rejected.
4. Issuance of the WI Certified Compliance Certificate is a prerequisite for District acceptance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver casework until painting and similar operations that could damage casework have been completed in installation areas.

B. If casework must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD 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: 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.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Standard for Materials and Workmanship: Comply with applicable requirements of the NAAWS (referred to as the "woodworking standard"). Where Contract Documents Show requirements that conflict with or augment the woodworking standard, comply with the most stringent requirements.

B. Adhesives and Glues: VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Regulatory Requirements, Seismic Design: Comply with requirements of the California Building Code, Part 2, Volume 2, Chapter 16 (State Chapter) "Structural Design Requirements," Sections 1613.1 and 1617, ASCE Section 7-16, Table 13.6-1, and WI construction methods for seismic design for schools and hospitals.

D. Regulatory Requirements, Accessibility: Casework shall comply with accessibility requirements of the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) 2010 ADA Standards for Accessible Design" and with the 2022 California Building Code, Chapter 11B, "Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing." Accessible casework shall comply with the following:

1. Counter Top Heights for Sinks and Lavatories**:** Where self-rimming sinks or lavatories are installed and indicated to be accessible, counter top heights shall be verified and coordinated so that the top rim shall not be more than 34 inches above the finished floor; for self-rimming sinks, counter top heights shall be set at +33-1/2 inches above the finish floor level.

2. Knee and Toe Space at Sink Counter Tops (Ref. CBC 11B-306): a. Width: 30 inches minimum clear width. b. Vertical Clearance: 27 inches minimum at the front edge. c. Depth: 19 inches minimum / 25 inches maximum at floor level.

3. Knee and Toe Space at Lavatory Counter Tops (Ref. CBC 11B-306): a. Width: 30 inches minimum clear width. b. Vertical Clearance: 29 inches minimum at the front edge. c. Depth: 17 inches minimum / 19 inches maximum at floor level.

4. Side Reach Depth Over Counter Tops (Ref. CBC 11B-308.3.2): Where casework is to be accessible, side reach depth shall not exceed 24 inches. Counter top heights shall not exceed 34 inches from the finished floor surface.

E. Adhesives and Glues: VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Moving or operating parts to function smoothly and correctly.

2.02 WOOD MATERIALS

A. Wood Veneer:
1. General: Conform to NAAWS Premium Grade requirements or HPVA Grade "AA," whichever is more restrictive or required for appearance match the Architect’s control sample.
2. Species and Cut: To be determined by the Architect.

3. Edge: “Self-edge” sliced from the same veneer flitch as exposed faces.

B. Solid Stock:

1. Concealed: Species and grade as specified in woodworking standard for casework construction, unless otherwise indicated.
2. Exposed: Premium Grade to match adjacent wood veneer.
3. Moisture content at time of fabrication: As specified in woodworking standard.
4. Provide wood dressed on all exposed faces.
5. Do not use twisted, warped, bowed, or otherwise defective wood.

2.03 PANEL MATERIALS

A. Hardwood Veneer Plywood: Non-toxic, urea formaldehyde free, hardwood plywood using soy-based adhesive; “PureBond” by Columbia Forest Products, Inc., “Freshply” by True North, or equal.
1. Face Veneer: Species as specified and in thickness not less than 0.02 inches.
2. Edge: “Self-edge” sliced from the same veneer flitch as exposed faces.

B. Softwood Plywood: DOC PS 1 of Types, grades, and cores in accordance with the woodworking standard
1. Provide AB Marine Grade plywood at locations subject to moisture.

C. Medium-Density Fiberboard (MDF): ANSI A208.2, formaldehyde free. FSC Certified; "Arreis” by SierraPine, Ltd, Roseville, CA, or equal.
1. Density: 47 pounds / cubic foot.
2. Type: Grade 130.
3. Thickness: 3/4 inch, unless otherwise required to meet NAAWS performance requirements.

D. Hardboard: Tempered Grade, conforming to standards of American Hardboard Association or PS-50; use smooth side exposed.

E. Particle Board: Not permitted.

2.04 PLASTIC LAMINATE MATERIALS

A. High-Pressure Decorative Laminate: NEMA LD 3, grades as specified below:

1. Manufacturers: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
   a. Formica Corporation.
   b. Nevamar Company, LLC; Decorative Products Div.
   c. Wilsonart International.

B. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces Other Than Tops: Grade HGL (1.0 mm).

2. Postformed Surfaces: Grade HGP (1.0 mm).

3. Vertical Surfaces: Grade VGS (0.7 mm).

C. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

D. Materials for Semi-exposed Surfaces: Thermoset decorative panels.

E. Concealed Backs of Panels: High-pressure decorative laminate, Grade BKL.

2.05 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with WI's "North American Architectural Woodwork Standards," Section 11 "Countertops" for Premium Grade.

B. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS or HGP as required.

C. Core Material: Medium-Density Fiberboard (MDF) complying with Article 2.03.

1. Counter tops for sinks to be AB Marine Grade Plywood complying with Article 2.03.

D. Edge Treatment:

1. Splash: Integral cove splash with square top, 4 inches high unless otherwise indicated.

2. Front Edge: Full round edge unless otherwise indicated.

E. Counter Top Edge Thickness: Build up counter top edge thickness to 1-1/2 inches at front, back, and ends with additional layers of core material.

F. Backer Sheet: Provide paper backing on underside of countertop substrate.

G. Cutouts: Edges of cut outs shall be sealed per WI Premium Grade requirements with a color toned water resistant varnish before sink or rims are installed.

2.06 CLOSET AND UTILITY SHELVING

A. Quality Standard: Comply with NAAWS, Custom Grade.

B. Shelf Material: 3/4-inch thermoset decorative panel with 0.12 inch (3 mm) PVC edge banding.

C. Cleats: 3/4-inch solid lumber.

2.07 HARDWARE

A. Comply with requirements of BHMA A156.9, Type 2 (Institutional).

B. Finishes:
1. Exposed Items: Satin stainless steel, 630, complying with ANSI/BHMA A156.18.
2. Concealed Items: Manufacturer's standard finish, complying with applicable product class of ANSI/BHMA A156.9.

C. Hinges: Provide two per door up to 36 inches high, three per door over 36 inches high.
1. Totally Concealed, Free Swinging: Häfele #329.06.602 or 611 or equal.
2. Totally Concealed, Self-Closing: Häfele #329.07.609 or 618, or equal.

D. Drawer Slides: Accuride, Knape & Vogt, or accepted equal. Provide two per drawer.
1. Type:
   a. Full depth of drawers; quiet type with nylon ball-bearing rollers; positive pull-out stop.
   b. Side mounted, lift out, full extension.
2. Capacity, per Pair: Not less than 100 pounds.
3. In addition to capacity, slides shall be sized in accordance with manufacturer’s recommendations for drawer width.

E. Pulls:
   1. Type: To be determined by the Architect.
   2. Quantity: One for each door or drawer, two for each drawer 30 inches or wider.

F. End Supported Shelf Supports: Right angle clips with quake hole for insertion into 1/4-inch holes, nickel finish; RPC, or equal.

G. Locks: CompX National #C8703/8704, or equal.
   1. Locations: To be provided by the Architect.
   2. Cylinders to be keyed into door keying system specified in Section 08 71 00, “Door Hardware.”

H. Bumper Pads (Silencers): Hemispherical, quiet clear type, 55 Shore A hardness; 3M Bumpon Protective Products, or equal.

2.08 ACCESSORIES

A. Bumper Pads (Silencers): Hemispherical, quiet clear type, 55 Shore A hardness; 3M Bumpon Protective Products, or accepted equal.

B. Adhesive: As recommended by panel manufacturer best suited for the intended use and that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Cabinet, Door, and Drawer Front Interface Style: Style 1, flush overlay.

E. Shelves: Shelves shall be adjustable and supported by shelf standards and clips.

   1. Design loading: 50 psf.

   2. Thickness: 3/4 inch minimum.

      a. Shelves over 26 inches in width shall be 1-inch minimum thickness.

   3. Adjustable shelf standards shall be recessed into cabinet sides.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items.

G. Fasteners: Size and type to suit application.

2.09 FABRICATION

A. Construction and assembly shall be in accordance with NAAWS requirements for wood casework including casework requirements of Appendix.

B. Grade: NAAWS Premium Grade.

C. Carcass Construction: Type A frameless. Provide as single unit at open shelving.

2.10 SHOP FINISHING

A. General:
   1. Coatings shall be shop applied and comply with NAAWS Premium Grade requirements.
   2. Surfaces of which are not exposed to view at any time and abut walls or floor shall be thoroughly back painted with one heavy coat of finishing material in shop.

B. Wood Veneer:
   1. Veneer Layup on Exposed Surfaces: To be determined by the Architect.
   2. Veneer faces shall be glue spliced. Stitched faces will not be accepted.
   3. Veneer matching shall be continuous across doors, drawer fronts, and panels.

C. Transparent Finish: CAB-acrylic lacquer; Sherwin Williams CCF23 or equal.
   1. Stain: To be finalized by the Architect and to match District's control sample.
   2. Vinyl Sealer: As recommended by finish coating manufacturer.
   3. Sheen: To match control sample.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required.

3.02 INSTALLATION OF CABINETS

A. Grade: Install cabinets to comply with NAAWS Premium Grade.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to walls as indicated on Drawings and in compliance with referenced seismic requirements.

F. 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.

3.03 INSTALLATION OF COUNTERTOPS

A. Grade: Install countertops to comply with NAAWS Premium Grade.

B. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches.

D. Install countertops level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut countertops to fit adjoining work.

F. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

G. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant

3.04 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces.

END OF SECTION

SECTION 066420
FIBERGLASS REINFORCED PLASTIC WALL PANELING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.
B. Related Requirements:
    1. Joint Sealants: Section 07 92 00.
    2. Gypsum Board: Section 09 29 00.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
    1. Action Submittals shall be submitted in accordance with Section 01 33 00, “Submittal Procedures.”

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.
    1. Include installation instructions.
    2. Include product data for panels, trim, adhesive, and sealant.
    3. Include VOC content and chemical components for adhesives and sealants.

B. Samples:
    1. Panels: 8-inch square, in specified color and finish.
    2. Trim: 6-inch lengths of each type.

1.04 QUALITY ASSURANCE

A. USDA/FSIS: Materials and installation shall meet USDA/FSIS requirements.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and a temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 FIBERGLASS REINFORCED PLASTIC (FRP) SHEET PANELING

A. Source Limitations: Obtain plastic paneling and trim accessories from a single manufacturer.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Crane Composites, Inc. (Glasbord)
    2. Kemlite Company Inc.
    3. Marlite
    4. Nudo Products, Inc. (Fiberlite FRP)
C. Fiberglass Reinforced Plastic Panels: Plastic panels complying with ASTM D 3841 comprised of thermosetting styrenated and acrylated polyester resins reinforced with glass fibers.
    1. Nominal Thickness: Not less than 0.090 inch.
    2. Surface Finish: Molded pebble texture.
    3. Color: As selected by Architect from manufacturer's full range of not less than six colors.
    4. Surface-Burning Characteristics: Class A as determined according to ASTM E 84.
        a. Flame-Spread Index: 25 or less.
        b. Smoke-Developed Index: 450 or less.

2.02 ACCESSORIES

A. Trim Accessories: Manufacturer's standard solid polymer moldings for inside corners, outside corners, and caps as needed to conceal edges.
    1. Color: Match panels.
B. Adhesive: As recommended by plastic paneling manufacturer.
    1. Shall be latex-based, low odor, non-flammable, and water and mold resistant.
    2. VOC Content: $50~g/L$ or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer.
    1. Color: Match panels.
    2. VOC Content: $250~g/L$ or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
D. Provide fasteners, trim, clips, cleaner and other materials as recommended by panel manufacturer and required for a complete installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove wall coverings, loose or soluble paint, and other materials that might interfere with adhesive bond.
B. Prepare substrate by sanding high spots and filling low spots as needed to provide a flat, even surface for panel installation.
C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
D. Condition panels and trim by unpacking and placing in the installation space before installation according to manufacturer's written recommendations.
E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
F. Mark plumb lines on the substrate at panel joint locations for accurate installation.

3.03 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.
B. Install panels vertically, cut to required height, without horizontal joints.
    1. Where panels are used as a wainscot 48-inches or less in height, install horizontally without vertical joints except where wall length exceeds maximum available panel length.
C. Install panels in a full spread of adhesive.
D. Set panels on top of flooring base.
E. Install trim accessories with adhesive and nails; do not fasten through panels.
F. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
G. Seal joints between panels with silicone sealant.
H. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
I. Remove excess sealant and smears as panels are installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.04 CLEANING

A. Clean soiled or discolored surfaces and panel faces after installation, using cleaning agents as instructed by the panel manufacturer.
B. Remove and replace damaged or improperly installed work.

END OF SECTION

SECTION 071300
SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. A pre-applied, integrally bonded sheet membrane waterproofing system for the exterior of the shallow elevator pit structure (underslab and vertical blindside walls).
2. All necessary accessory products, tapes, and detailing compounds to create a complete, monolithic, and watertight barrier.
3. Work of this Section shall be installed in conjunction with Crystalline Waterproofing as specified in Section 07 16 16 - Crystalline Waterproofing to form a complete, dual-system waterproofing barrier for the elevator pit. Coordinate all work and transitions between the two systems.

B. Related Sections:

1. Section 03 30 00 - Cast-in-Place Concrete
2. Section 31 20 00 - Earth Moving
3. Section 31 50 00 - Excavation Support and Shoring
4. Section 07 90 05 - Joint Sealers: Sealant for joints in substrates.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D5385: Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
2. ASTM D903: Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
3. ASTM E154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
4. ASTM D1970: Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection (reference for low-temperature flexibility).

1.3 SUBMITTALS

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

B. Product Data: Submit manufacturer's technical data sheets and installation instructions for each component of the waterproofing system.

C. Samples: Submit samples of the primary waterproofing membrane and accessory tapes.

D. Warranty: Submit a sample copy of the manufacturer's standard system warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have a minimum of 10 years of experience in manufacturing pre-applied waterproofing membranes.

B. Installer Qualifications: Installer shall be approved or certified by the waterproofing system manufacturer and have a minimum of 5 years of experience installing similar systems on projects of comparable scope.

C. Installer's Field Supervision: Installer to maintain a full-time Supervisor/Foreman on the job site during all phases of waterproofing work and at any time work is in progress. Proper supervision of workmen shall be maintained at all times. A copy of the specification shall be in the possession of the Supervisor/Foremen and in the area of work at all times.

C. Pre-Installation Meeting: Conduct a pre-installation meeting with the General Contractor, Concrete Contractor, Excavation Contractor, and Installer's representative to review substrate conditions, scheduling, and detailing procedures.

1.5 WARRANTY

A. Provide manufacturer's standard 5-year system warranty covering material defects and ensuring the system will prevent the passage of water and resist lateral water migration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: GCP Applied Technologies; PREPRUFE® Plus Waterproofing System.

1. Horizontal (Underslab): PREPRUFE® 300R Plus Membrane
2. Vertical (Blindside): PREPRUFE® 160R Plus Membrane
3. Accessories: PREPRUFE® Tape, BITUTHENE® Liquid Membrane, and ADCOR® 500S Waterstop as required by manufacturer's standard details.

B. Or Equal: Systems must be pre-applied, composite sheet membranes comprising a high-density polyethylene (HDPE) film, a pressure-sensitive adhesive, and a protective coating that forms an integral, mechanical, and adhesive bond to freshly placed concrete, preventing lateral water migration.

1. Approved "or equal" manufacturers and products must be submitted in accordance with Substitution procedures.
2. "Or equal" systems must demonstrate equivalent performance to the Basis of Design product in all specified ASTM standards, particularly ASTM D5385 (Hydrostatic Head) and ASTM D903 (Peel Adhesion to Concrete).

2.2 MATERIALS

A. Underslab Waterproofing Membrane: (Basis of Design: PREPRUFE® 300R Plus)

1. Description: A composite sheet membrane, nominally 1.2 mm (46 mil) thick, consisting of an HDPE film, pressure-sensitive adhesive, and protective coating.
2. Laps: Must feature an integrally bonded adhesive-to-adhesive lap, such as the "ZipLap™" system.
3. Physical Properties:
    - Hydrostatic Head Resistance (ASTM D5385): > 231 ft (70 m)
    - Peel Adhesion to Concrete (ASTM D903): > 5.0 lbs/in (880 N/m)
    - Lateral Water Migration Resistance: Pass (No migration)

B. Vertical Blindside Waterproofing Membrane: (Basis of Design: PREPRUFE® 160R Plus)

1. Description: A composite sheet membrane, nominally 0.8 mm (32 mil) thick, consisting of an HDPE film, pressure-sensitive adhesive, and protective coating.
2. Laps: Must feature an integrally bonded adhesive-to-adhesive lap, such as the "ZipLap™" system.
3. Physical Properties:
    - Hydrostatic Head Resistance (ASTM D5385): > 231 ft (70 m)
    - Peel Adhesion to Concrete (ASTM D903): > 5.0 lbs/in (880 N/m)
    - Lateral Water Migration Resistance: Pass (No migration)

2.3 ACCESSORIES

A. Seam Tape: (Basis of Design: PREPRUFE® Tape) Manufacturer's standard, pressure-sensitive tape for sealing cut edges, roll ends, and penetrations.

B. Detailing Compound: (Basis of Design: BITUTHENE® Liquid Membrane) Manufacturer's standard two-component or single-component, cold-applied liquid for sealing around complex penetrations and at terminations.

C. Waterstop: (Basis of Design: ADCOR® 500S) Hydrophilic, swellable waterstop for application at all construction joints (e.g., pit floor-to-wall joint).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all substrates are suitable for membrane installation.

1. Horizontal: Substrate (mud slab or well-compacted earth/gravel) shall be smooth and free of voids, sharp protrusions, or loose material.

2. Vertical: Lagging, soil retention, or formwork shall be sound and provide a uniform surface. Gaps or voids greater than 0.5 in (12 mm) shall be filled.

B. Notify Architect of any unsatisfactory conditions. Do not proceed with installation until substrates are corrected.

3.2 INSTALLATION

A. Install waterproofing system in strict accordance with the manufacturer's written installation instructions and approved project-specific detail drawings.

B. Horizontal (Underslab) Installation:

1. Install PREPRUFE® 300R Plus membrane over the prepared substrate with the adhesive side (ZipLap™ side) up, facing the concrete pour.
2. Overlap all seams a minimum of 3 in (75 mm) per manufacturer's instructions, ensuring the adhesive-to-adhesive bond is continuous and free of contaminants.
3. Stagger all end laps. Seal all roll ends and cut edges with PREPRUFE® Tape.

C. Vertical (Blindside) Installation:

1. Install PREPRUFE® 160R Plus membrane vertically against the lagging or retention system, fastening mechanically at the top edge per manufacturer requirements.
2. Orient membrane with the adhesive side facing the concrete pour.
3. Overlap all seams a minimum of 3 in (75 mm) and roll firmly to ensure a continuous bond.
4. Ensure vertical membrane overlaps the horizontal membrane at the perimeter by a minimum of 6 in (150 mm) or as detailed.

D. Detailing:

1. Penetrations: Detail all pipes, conduits, and structural penetrations as per the manufacturer's standard details, using combinations of PREPRUFE® Tape and BITUTHENE® Liquid Membrane to ensure a watertight seal.
2. Construction Joints: Install ADCOR® 500S waterstop at the center of the floor-to-wall construction joint, adhering to the cured concrete slab prior to the wall pour, or as detailed by the manufacturer for pit construction.
3. Transition to Under-Slab Vapor Retarder: At the perimeter of the elevator pit where the waterproofing membrane terminates and transitions to the main building's under-Slab vapor retarder ,Section 03 05 16, install the PREPRUFE® membrane to overlap the vapor retarder by a minimum of 12 inches. a. Ensure the vapor retarder is clean, dry, and free of all contaminants. b. Apply a continuous, 60-mil coat of BITUTHENE® Liquid Membrane to seal the transition, centered over the edge of the PREPRUFE® membrane. c. Extend the liquid membrane a minimum of 3 inches onto the

PREPRUFE® membrane and 3 inches onto the vapor retarder, creating a minimum 6-inch-wide, monolithic, and watertight seal.

3.3 FIELD QUALITY CONTROL

A. Inspect all membrane seams, laps, and details prior to placement of reinforcement.

B. Repair any damaged areas, punctures, or non-compliant laps per the manufacturer's instructions. Repairs must be made using a patch of the primary membrane and sealed with tape or liquid membrane.

3.4 PROTECTION

A. Protect the installed membrane from damage by subsequent trades, placement of rebar, and concrete pouring operations.

B. Do not use sharp or damaging tools when placing reinforcement. Use rebar chairs with a flat, sand-shoe base.

C. Ensure concrete is placed carefully to avoid displacing the membrane.

END OF SECTION

SECTION 071616
CRYSTALLINE WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Crystalline waterproofing.

B. Preparation of surfaces to be waterproofed, including plugging active water leaks.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete work to be waterproofed.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.

B. Provide complete submittals at the same time as submittals for work in related sections to permit review of complete and integrated systems and assemblies.

C. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Test data showing hydraulic permeability.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. Details for waterproofing at joints, intersections, and other special conditions.

D. Specimen warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of products of the type specified and providing technical representatives to visit project site.

B. Installer Qualifications: Acceptable to manufacturer, with documented experience on at least 5 projects of similar nature within the last 5 years.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Take necessary precautions to keep cementitious materials dry.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

B. Provide installer's warranty agreeing to correct leaking waterproofing for 2 years from Date of Substantial Completion, unless leakage is caused by structural failure, movement of the structure, or other causes beyond the installer's control.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Crystalline Waterproofing:
   1. W.R. Meadows, Inc.; CEM-KOTE CW PLUS: www.wrmeadows.com.
   2. Xypex Chemical Corporation; XYPEX Concentrate: www.xypex.com.
   3. Substitutions: See Section 01 2513 – Product Options and Substitutions.

2.02 APPLICATIONS

A. Waterproofing for building surfaces:
   1. Inside of elevator pits.
   2. Surfaces indicated on drawings.

2.03 MATERIALS

A. Crystalline Waterproofing: Portland cement and chemical compound that when applied to the surface of concrete forms insoluble crystals in the capillary pores preventing the passage of liquids, while having no adverse effect on the normal properties of concrete.
   1. Hydraulic Permeability: No measurable leakage or water flow at 200 psi pressure when tested in accordance with COE CRD-C 48, using minimum 2 inch thick sample and 20 days duration.
   2. Toxicity: Non-toxic.
   3. Color: Gray.

B. Plugging Compound: Cementitious compound meeting requirements specified for waterproofing, with additional characteristic of rapid set under water, recommended or approved by waterproofing manufacturer.

C. Patching Compound: Ready-mixed cementitious mortar recommended or approved by waterproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Use sand blasting, water blasting, or acid etching as recommended.

C. Plug water leaks.

D. Patch holes, construction joints, and cracks. Remove defective concrete.

E. Obtain approval of manufacturer's field representative before beginning installation.

3.03 INSTALLATION

A. Install in strict accordance with manufacturer's instructions. Maintain environmental conditions required and recommended by manufacturer. Keep a copy of manufacturer's instructions on site.

B. Coordinate installation with installation of products that must penetrate waterproofed surfaces.

C. Prevent excessive drying of surface.
   1. Cure waterproofing for at least 3 days, or length of time required by manufacturer, with water spray and adequate air circulation.
   2. Do not use chemical curing agents unless explicitly approved by waterproofing manufacturer.

D. Do not backfill, fill water or liquid holding structures, or apply finish coatings until time period recommended by manufacturer has passed.

3.04 PROTECTION

A. Protect from damage by weather. Do not cover with impermeable (plastic) sheeting unless air circulation is provided.

B. Touch-up, repair or replace damaged waterproofing after Substantial Completion.

END OF SECTION

SECTION 072117
THERMAL BOARD AND BLANKET INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Batt insulation at exterior framed walls.
2. Continuous board insulation at exterior wall systems.
3. Mounting clips for continuous exterior board insulation.

B. Related Requirements:

1. Acoustical Insulation and Sealants: Section 09 82 00; interior acoustic insulation and sound isolation requirements.
2. Plumbing: Division 22; plumbing pipe insulation.
3. Mechanical: Division 23; mechanical pipe and duct insulation.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 33 00 “Submittal Procedures.”

B. Coordinate design and spacing of furring and fiberglass clips securing insulation with attachment requirements of respective rainscreen system.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation recommendations for each type of insulation required.

1. Provide Underwriter's Laboratory approval numbers for required fire ratings.
2. Approval of other laboratories is contingent upon acceptance by applicable authorities.

B. Sustainable Design

1. Submit information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.
2. Sustainable design submittals are in addition to other submittals.
3. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal.

1.04 QUALITY ASSURANCE

A. Thermal resistance factors (R-values) listed are aged values tested in accordance with ASTM C518 at 75 degrees Fahrenheit and 50 percent relative humidity for at least six months.

B. Regulatory Requirements:

1. Insulation shall be certified by manufacturer to comply with state standards for

insulating materials.
2. Insulation shall comply with Flame Spread Rating and Smoke Density requirements of CBC Section 707.3.

C. Mockups:

1. The first area or example of each type of installation shall serve as a mockup for review of workmanship by Architect.
2. Do not proceed with installation until mockup is approved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Products shall be delivered to jobsite with labels clearly identifying manufacturer, contents, brand name, applicable standard, and R-value.

B. Store materials off ground, protected against weather, condensation, and damage.

C. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Regulatory Requirements:

1. California Building Code.
2. California Energy Code.
3. Part 12, Title 24, CCR Standards for Insulating Materials.

2.02 BLANKET INSULATION

A. Unfaced Glass Fiber Blankets: Lightweight fiberglass, formaldehyde free, conforming to ASTM C665 Type I; Class A, Category 1, unfaced, high-density, “EcoTouch PINK Fiberglas Insulation” by Owens Corning, “Formaldehyde-free” insulation by Johns Manville, “CertaPro” Thermal Batts by CertainTeed Corporation, or equal.

1. Fire Resistive Requirements: ASTM E84.
   a. Blanket:
      1) Smoke Developed: 50 or less.
      2) Flame Spread: 25 or less.
      3) Smoke Developed Rating: 50 maximum, per ASTM E84.
      4) Passing ASTM E 136 for combustion characteristics.
2. Thickness: As shown.
3. Thermal Resistance: R-values indicated on Form NRCC-Env-01-E or NRCC-PRF-01-E.
4. Certification: “GREENGUARD” certified to be formaldehyde free.

B. Acoustical Glass Fiber Batt Insulation: ASTM C 665, Type I unfaced; Sound Control Batts by Johns Manville; EcoBatt Quiet Therm by Knauf Insulation GmbH. Or approved equal.

1. Insulation consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics; formaldehyde-free.
2. Location: Where acoustical insulation is indicated.

3. STC of Assembly: 26 or better, in framed and finished wood stud wall.
4. Size and Thickness: Fill cavity width, height or length, and depth for continuity of acoustical barrier.
    a. At installations above ceilings, thickness and extent as indicated in Drawings.

C. Do not use salvage cut-offs, materials less than space width, or multiple short lengths within single cavity.

2.03 BOARD INSULATION

A. Extruded polystyrene (XPS) Rigid Foam Insulation: ASTM C578 Type X, ASTEm E119 Fire Resistance Rated Wall Assemblies, conforming with the following Thickness: As indicated.

1. Insulating Value per Inch of Thickness: R-5/in (1.5 inches thick) or approved equal.
2. Moisture Absorption: 1 percent maximum when tested in accordance with ASTM C1104.
3. Fungi Resistance: Zero mold growth when tested in accordance with ASTM C1338.
4. Corrosive Resistance:
    a. Steel to ASTM C665: Pass.
    b. Stainless steel to ASTM C795: Conform.

2.04 ACCESSORIES

1. Foamed in Place Insulation: Single-component, low-pressure build, polyurethane self-expanding foam insulation formulated to seal air-gap and annular spaces in commercial construction.
2. Product: Dow, GreatStuff Pro Window and Door Insulating Foam Sealant

B. String wire: Minimum 16 gauge galvanized annealed steel wire spaced at 18” on center.

C. Sill Sealer: Self-adhesive air and moisture barrier; “Triple Guard Energy Sill Sealer” by Protector Wrap, or equal.

D. Additional Fastenings, Straps, Adhesives, and Accessories: As acceptable to insulation manufacturer and required to secure insulation in place.

PART 3 - EXECUTION

3.01 INSTALLATION OF THERMAL BLANKETS

A. Install to fill all typical and odd spaces completely in framing where required, other than providing air space where indicated.

B. Install snugly between framing members with facing to building interior. Provide straps to prevent sagging at vertical applications exceeding 8 feet, and netting at horizontal applications, to prevent sagging. If faced batts have tabs, tape tabs to metal studs to prevent sagging.

C. Trim to required height and width in place.

D. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations. Split blankets around wires as required.

E. Shim space between framing and window and door jambs shall be filled solid with unfaced batt or foam-in-place insulation. Fill spaces completely to a uniform monolithic density

without voids.

F. Where wall blankets are not in contact with gypsum board, provide straps to prevent sagging.

G. Shim space between framing and window and door jambs shall be filled solid with unfaced batt or foam-in-place insulation. Fill spaces completely to a uniform monolithic density without voids.

3.02 INSTALLATION OF RIGID INSULATION AT CLADDING DRAINAGE

A. Install thermal isolation clips over weather barrier to solid backing in accordance with manufacturer's recommendations for specified cladding panels.

B. Friction fit insulation in place over approved weather barrier:

1. Score or cut insulation down its centerline to 50 percent maximum of its depth to enable fitting insulation in correct position.
2. Fold edges of insulation board back to enable friction fitting in correct position. Position edges of partially folded board into space between girts and thermal spacers, and flatten partially folded board against substrate.
3. Ensure insulation is tightly fitted with sides of insulation slightly compressed at each insulation spacer.

C. Secure insulation with corrosion resistant mechanical fasteners in accordance with layout recommended by insulation manufacturer.

D. Do not install overlying wall cladding until insulation has been reviewed and approved by the Owner.

3.03 FIELD QUALITY CONTROL

A. Prior to applying overlying materials, obtain by observation the IOR and Architect of insulation installation.

3.04 PROTECTION

A. Where coordination with other Sections is not practical, protect insulation by temporary covering or enclosure.

END OF SECTION

SECTION 074113
INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section Includes:
   1. Foamed-insulation core standing seam metal roof panels.
   2. Fastening system.
   3. Factory finishing.
   4. Metal trim and accessories and miscellaneous components: Flashings, fasteners, and accessories as required for weatherproof installation.

B. Related Requirements:
   1. Section 05 12 00 - Structural Steel Framing: Roof framing and purlins.
   2. Section 06 10 53 – Miscellaneous Rough Carpentry: Roof sheathing.
   3. Section 06 16 43 – Gypsum Sheathing

1.02 REFERENCE STANDARDS

A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

B. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

E. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

F. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

G. California Code of Regulations, Title 24, Part 2, California Building Code (CBC), International Building Code

H. California Code of Regulations, Title 24, Part 11 California Green Building Standards Code, “CAL-Green”.

I. Sheet Metal and Air Conditioning Contractors National Association: "Architectural Sheet Metal Manual".

J. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 33 00, "Submittal Procedures."
2. Closeout Submittals shall be submitted in accordance with Section 01 77 00, “Closeout Procedures,” and Section 01 78 36, “Warranties.”
3. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 SUBMITTALS

A. General: Submit in accordance with General Conditions as specified in Section 01.

B. Product Data: For each type of product indicated, demonstrate compliance with specified attributes. Manufacturer's data sheets on each product to be used, including:
1. Summary of test results, indicating compliance with specified requirements.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Specimen warranty.

C. CAL-GREEN Submittals: Product Data.
1. VOC Limits: For adhesives sealants, fillers, primers and coatings, documentation including printed statement of VOC contents, comply with limits specified in related section.
2. Product Test Reports: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement and demonstrate Cool Roof Rating Council (CRRC) listing.

D. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, details of trim, gutter, ridge, curved panel and flashing conditions, fastening and anchorage methods, weatherproofing techniques, terminations, and flashing of each type of penetrations, and special conditions.
1. Show work to be field-fabricated or field-assembled.
2. Include structural analysis signed and sealed by qualified structural engineer, indicating conformance of roofing system to specified loading conditions.
3. Indicate metal thickness and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations; purlin and girt locations, thermal expansion provisions and special supports.
4. Include roof plan showing clip spacing at ridge, eave and field.
5. Indicate relationships with adjacent and interfacing work. Demonstrate continuity of air barriers with related wall assemblies and roof underlayment.
6. Shop drawings must be completed by the metal roof panel manufacturer's engineering department.
7. All changes recommended by Contractor must be approved by the manufacturer in writing prior to submittal.

E. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
1. Include typical panel joint in sample.
2. Include typical fastening detail.

G. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 INFORMATIONAL SUBMITTALS

A. Delegated-Design Submittal: For metal roofs indicated to comply with performance requirements and design criteria, substantiating system performance, structural capacity, anchorages and

fasteners sizes and spacings per specified criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and anchorage of metal roofs.
2. Include design calculations.
3. Provide clip fastener pull-out test report and calculations.

B. Qualification Data: For qualified Installer and testing agency.

C. Professional Engineer Qualifications: Demonstrate compliance with specified requirements.

C. Preconstruction Test Reports: For sealant.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance with performance requirements. For each system provide test reports with shop drawings.

E. Design test reports:
1. Indicate fastener types and spacings; and provide fastener pullout values.
2. Test report for the IMF Roof Panels: NOA. NO. 22-0214.06
3. Submit test results meeting or exceeding values specified in the Performance Criteria Article of this specification and stamped by an independent Testing Agency.

F. Certificates:
1. Manufacturer's Certificate that all products conform to specified requirements.
2. Manufacturer's Representative Certificate that installation conforms to specified requirements.

G. Quality-control reports.
1. Field quality-control reports.

H. Warranties: Sample of special warranties.

1.06 SCHEDULING AND SEQUENCING

A. Include in construction schedule:
1. When field measurement for factory production will be taken.
2. Order and delivery time.
3. Installation period.

B. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for preformed metal roofing system.

C. Schedule field measurements far enough in advance, to permit fabrication of panels to required lengths without delay to the construction schedule.

D. Sequence installation to avoid other activities over metal roofing.

E. Do not cover underside of metal roofed areas until water intrusion test has been performed.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project.
1. Not less than 5 years of documented experience.

B. Installer Qualifications: Company specializing in the type of work specified, with not less than five (5) years of documented experience; trained and authorized by roofing system manufacturer with written certification from manufacturer.
   1. Maintain a full-time supervisor/foreman with minimum of five (5) years experience with the installation of system similar to that specified on the job-site at all times during installation of new roof system.
   2. Upon Owner request, fabricator/installer shall submit work experience and evidence of adequate financial responsibility. The owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

C. Delegated Design: Design metal roof assembly components and anchorages under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at California.

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of assemblies that are similar to those indicated for this Project in material, design, and extent.

E. Engineering Responsibility: Prepare design for metal roof systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

F. Manufacturer's Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

G. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to prevent damage to panels prior to installation.

C. Order materials based on field measurements, not on construction drawings.

D. Deliver, store, protect and handle products to site under provisions of Section 01 60 00 - Product Requirements.

E. Coordinate delivery schedule with installation schedule. Do not deliver materials of this section to project site until suitable facilities for storage and protection are available.

F. Protect materials from damage during transit and at project site. Store under cover, off ground, sloped to provide positive drainage, protected from wind, foreign material contamination, mechanical damage, cement, lime or other corrosive substances. Do not expose materials with strippable protective film to direct sunlight or extreme heat.

1. Store preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
2. Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipment, storage, and handling.
3. Prevent contact with materials which may cause discoloration or staining

G. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

H. Do not allow storage of other materials or allow staging of other work on installed metal panel roof system.
1. Do not overload roof with stored materials.
2. Do not support roof mounted equipment directly on roofing system.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 20 year period from date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for watertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of 30 years from date of Substantial Completion.
1. Warranty must cover calculated wind speed.

PART 2 - PRODUCTS

2.01 DESIGN REQUIREMENTS

A. Roof Panel System: Provide roof system with performance as specified when installed, designed in accordance with applicable codes.
1. Make watertight.
2. Make free from objectionable warp, wave and buckle.

B. Provide structural performance appropriate to substrate over which roof system is installed.

C. Design and size components to withstand loads caused by wind pressures as specified in applicable code.

D. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range are not acceptable.

E. Drainage: Provide positive drainage to exterior for moisture entering building enclosure or condensation occurring within exterior building envelope.

2.02 MANUFACTURERS

A. Basis of Design Manfacturer for Insulated Metal Roof Panels: METL-SPAN, a Nucor Company, Lewisville, Texas, Tel. 972.221.565: Email: Info@metlspan.com; Web: Metlspan.com.

B. Basis of Design Product: METL-SPAN CFR insulated metal panel.

C. Obtain all components of roof system from a single manufacturer including good materials if required to comply with metal roof manufacturer warranty. Secondary products required which cannot be supplied by the specified metal roof manufacturer must be those recommended and approved in writing by the specified metal roof manufacturer.

D. Substitutions: See Section 01 - Product Requirements.
   1. Requests for substitution of proposed alternate systems must meet or exceed all performance requirements listed in Performance Criteria, Warranty and Quality Assurance Articles.
   2. Submit complete product and test data for each proposed substitution.

2.03 FOAM CORE ROOF PANELS

A. Foamed-Insulation Core Standing Seam Metal Roof Panels, with related metal trim and accessories. Basis of design Manufacturer: METL SPAN, a Nucor Company, Lewisville, Texas.

B. Standing Seam, Foamed-Insulation-Core metal roof panels: Structural Metal Panels consisting of an exterior standing seam with an interior tongue and groove joint. Coupled with a vapor seal in the standing seam and provides superior resistance to air and moisture intrusion.

C. 4” Thick, 42” wide panels, with minimum R-Value of 32, Class A, Flame Spread not to Exceed 25 and smoke development of less than 450.

D. Insulating Core: Polyisocyanurate with zero ozone depletion potential blowing agent

   1. Closed Cell Content: 90% or more as determined by ASTM D 6226
   2. Compressive Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM D 1621
   3. Shear Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM C 273
   4. Tensile Strength: As required to meet structural performance requirements and with a minimum of 16 psi ASTM D 1623
   5. Minimum Density: 2.0 pcf (32 kg/m3) as determined by ASTM D 1622

F. G-90 Galvanized coated steel: ASTM 653 or Aluminum-Zinc alloy coated steel; ASTM A 792/A 792M, Structural quality, grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), Prepainted by the coil-coating process per ASTM A 55/A 7555M. E. Exterior face sheet, 24 GA Interior face sheet 26 GA.

F. Endlaps: provide panels with factory endlaps, notching, swedging and backer plates where panel lengths permit.

G. Low eave treatment: provide cutback for trim/gutter installation: where panel lengths permit.

2.04 METAL ROOF PANEL ACCESSORIES

A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Provide corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

D. Joint Sealers: Provide Tape Mastic Sealants and Concealed Joint Sealants per Section 07 92 00, "Joint Sealants".

E. Roof Accessories: Provide curbs, equipment supports, roof hatches, heat and smoke vents, ventilators, and preformed flashing sleeves compatible with standing seam roof and approved by metal panel manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
   1. Determine if work of other trades which penetrates the roof or is to be made watertight by the roof is in place and approved prior to installation of roofing.
   2. Verify pipes, sleeves, or vents through roof are solidly set, reglets are in place, and nailing strips located.
      a. Locate penetrations in the center of roofing panel.
   3. Verify roofing termination, base flashings and gutter flanges are in place, sealed, and secure.
   4. Notify Architect in writing if substrates are not suitable for application of panel system.
   5. Do not proceed with installation until substrates are acceptable.

B. Structural surfaces: Smooth, even, sound, surface dry 19 percent maximum, clean and free of depressions, waves, or projections before material is applied.
   1. Examine the alignment and placement of the building structure and substrate. Correct any objectionable warp, waves or buckles in the substrate before proceeding with installation of the preformed metal roofing. The installed roof panels will follow the contour of the structure and may appear irregular if not corrected. C. Apply no materials during wet weather or on wet surface.

3.02 INTERFACE WITH OTHER WORK

A. Coordinate with roof accessories, miscellaneous sheet metal accessories, piping vents and other items specified in related sections penetrating metal roofing work. Avoid conflict or omission in waterproofing systems and provide watertight installation.

3.03 PREPARATION

A. Verify field dimensions prior to ordering materials.
   1. Establish straight side and crosswise benchmarks.
   2. Check rectangular roofs for squareness and straightness. Gable ends may not be straight; set a true line for the gable clips and flashing with stringline.
   3. Measure the roof lengthwise to confirm panel lengths, overhangs, coverage of flashings at eaves and ridges and verify clearances for thermal movement.

3.04 INSTALLATION

A. Overall: Install roof system when the atmospheric dry bulb temperature is minimum forty (40) degrees Fahrenheit and rising

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
   1. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

C. Flashings: Coordinate to provide weathertight conditions at roof terminations. Fabricate and install in accordance with standards of SMACNA Manual.

D. Install 1 layer of underlayment on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 4 inches and side and end laps a minimum of 6 inches. Offset seams in successive layers of underlayment.

E. Comply with all details and install roofing materials and flashings in accordance with approved shop drawings and manufacturer's product data within specified erection tolerances.

3.05 FIELD QUALITY CONTROL

A. Testing:
   1. Re-test until roof is shown to be watertight.

B. Manufacturer Field Services: Provide daily site inspection for a minimum of one (1) hour during active roofing operations by an experienced, full-time employee of the roofing manufacturer. Submit written reports as specified.

3.06 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

B. Touch up minor abrasions and exposed fasteners with matching paint provided by panel manufacturer. Remove and replace panels that cannot be satisfactorily touched up.
   1. No exposed sealant or visible raw metal.

C. Sweep and remove chips, shavings, and dust from roof on a daily basis during installation period. Leave installed work clean, free from grease, finger marks and stains. D. Upon completion of installation, remove scraps and debris from project site.

3.07 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before the Date of Substantial Completion.

END OF SECTION

SECTION 074213
INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Foamed-insulation-core concealed fastener metal wall panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.

B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.

C. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.

D. Division 07 Section "Metal Wall and Roof Panels" for factory-formed metal wall, roof, and soffit panels.

1.3 REFERENCES

A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:

1. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM): www.astm.org:

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A 792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM A 666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
5. ASTM C 518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
7. ASTM C 273 – Properties of Sandwich Core Materials
8. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
9. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
10. ASTM D 1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
11. ASTM D 2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
12. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
13. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
14. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics

15. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
16. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
17. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
18. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
19. ASTM E 2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies

D. National Fire Protection Association (NFPA)

1. NFPA 259 – Test Method for Potential Heat of Building Materials.
2. NFPA 285 – Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies.
3. NFPA 286 – Fire Test of Evaluating Conditions of Wall and Ceiling Finish to Roof Fire Growth.

E. FM Global (FM): www.fmglobal.com:

1. FM 4880 Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials
2. FM 4881 Approval Standard for Class 1 Exterior Wall Systems.

1.4 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer approved under an accredited third-party quality control program

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum ten years' experience in the manufacturing of similar products and successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

    a. Product data, including certified independent test data indicating compliance with requirements.
    b. Samples of each component.
    c. Sample submittal from similar project.
    d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
    e. Sample warranty.
    f. Certificate from an accredited third-party Quality Control Program.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements
3. Approved manufacturers must meet separate requirements of Submittals Article.

C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years' experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.

1.6 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Include data indicating compliance with performance requirements.
2. Indicate points of supporting structure that must coordinate with metal panel system installation.
3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification:

1. Provide 12-inch long section of each metal panel profile.
2. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Results: Indicating compliance of products with requirements.

B. Qualification Information: For Installer

C. Warranty:

1. Submit manufacturer’s written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
2. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.

1. Deliver, unload, store, and erect metal panels and accessory items without deforming panels or exposing panels to surface damage from weather or construction operations.

2. Store in accordance with Manufacturer's written instructions.
3. Shield foam insulated metal panels from direct sunlight until all components are installed.

1.10 WARRANTY

A. Special Manufacturer’s Warranty: Submit Manufacturer’s two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.

B. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

C. Special Panel Finish Warranty: Submit Manufacturer’s limited warranty on the exterior paint finish for adhesion to the metal substrate and limited warranty on the exterior paint finish for chalk and fade.

1. Fluoropolymer Two-Coat System:

a. Color fading in excess of [5] or [10] for copper, silver metallic and bright red; Hunter units per ASTM D 2244.
b. Chalking in excess of [6] for copper, silver metallic and bright red or [8] rating per ASTM D 4214.
c. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: Metl-Span, a Nucor company; Lewisville, Texas Tel: 844.574.5367; Email: info@metlspan.com; Web: metlspan.com.

B. Provide basis of design products or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 applied in accordance with ICC AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:

1. Wind Loads: Determine loads based on applicable building code, wind speed, importance factor, exposure category, and pressure coefficients indicated on drawings.
2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection as shown on structural drawings of the span with no evidence of failure.

C. FM Approvals Listing: Comply with FM Approval 4881. Provide metal wall panel assembly listed in FM Approvals' "Approval Guide."

D. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by testing and inspection agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: The insulating core shall have been tested per ASTM E 84. The core shall have:

a. Flame spread index: 25 or less.
b. Smoke developed index: 450 or less.

2. Room Test Performance: FM Global 4880: The panel assembly shall meet the performance requirements cited by FM 4880, classifying the exterior building panel as Class 1 and ensuring large-scale integrity when exposed to flame.
3. Fire Propagation: The fire assembly shall meet the requirements of the standard for NFPA 285
4. Fire Growth: The fire assembly shall meet the requirements of the standard for NFPA 286
5. Potential Heat: Determined in accordance with NFPA 259
6. CBC Chapter 26: Panel Performance under the above test methods, shall meet the requirements of CBC, Chapter on foam plastics.

E. Air Infiltration, ASTM E 283: < 0.01 cfm/ft2 air infiltration rate at static pressure differential of 6.24 psf.

F. Water Penetration Static Pressure:

1. ASTM E 331: No uncontrolled water penetration at a static pressure of 15 lbf/sq. ft. for 15 minutes.
2. ASTM E 331 Modified (2-hour duration): No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft.

G. California Building Code Compliance: Provide insulated metal wall panels complying with requirements for installation under the 2022 California Building Code (CBC), including all applicable wind load requirements per ASCE 7-16. Where applicable, panels and anchorage systems shall also be designed and tested to comply with the seismic design requirements for the project's specific Seismic Design Category (SDC)..

H. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

I. Thermal Performance: When tested in accordance with ASTM C 518, Measurement of Steady State thermal Transmission, the panels shall provide a k factor of 0.112 btu-in/hr-sf-deg F at a 35° F (1.67° C) mean temperature.

2.3 INSULATED METAL WALL PANELS

A. Concealed Fastener, Insulated Metal Panel with foam core: Structural metal panels consisting of flush, flat exterior metal sheet, and interior metal sheet with a Light Mesa profile, with factory foamed-in-place polyisocyanurate core, with tongue-and-groove panel edges, attached to supports using concealed fasteners.

1. Basis of Design: Metl-Span, CF Flute
2. G-90 galvanized coated steel conforming to ASTM A 653 or AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.

a. Exterior Face Sheet: 24-gauge thickness, with stucco embossed surface.

1. Finish: Fluoropolymer two-coat system.

2. Color: As selected by Architect from manufacturer's standard colors.

b. Interior Face Sheet: 26 gauge thickness, with stucco embossed Light Mesa profile.

1. Finish: Fluoropolymer two-coat system.

2. Color: As selected by Architect from manufacturer's standard colors.

3. Panel Width: 42 inches
4. Panel Thickness: 2.5 inch
5. Insulating Core: Polyisocyanurate with zero ozone depletion potential blowing agent
    a. Closed Cell Content: 90% or more as determined by ASTM D 6226
    b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM D 1621
    c. Shear Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM C 273
    d. Tensile Strength: As required to meet structural performance requirements and with a minimum of 16 psi as determined by ASTM D 1623
    e. Minimum Density: 2.0 pcf as determined by ASTM D 1622
    f. Thermal Resistance R-Value: 21.9 deg. F * hr * sq. ft./Btu per ASTM C 518 at 35 degrees Fahrenheit mean temperature.
6. Heat Transfer Coefficient (U-factor): 0.047 Btu/hr * sq. ft. * deg. F as determined by ASTM C 1363 and/or thermal modeling consistent with ASHRAE 90.1 section A9.4.7 at 35 degrees Fahrenheit mean temperature. Specimens must include at least two engaged side joints.

B. Concealed Fastener, Insulated Metal Wall Panels with foam core: Structural metal panels consisting of exterior metal sheet and interior metal sheet with matching 4 by 1/8 inch o.c. profile. Factory foamed-in-place polyisocyanurate core, with tongue-and-groove panel edges, attached to supports using concealed fasteners.

1. Basis of Design: Metl-Span, CF Tuff Wall
2. G-90 galvanized coated steel conforming to ASTM A 653 or AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.
    a. Exterior Face Sheet: 24 gauge thickness, with heavy stucco embossed surface.
        1. Finish: Fiber-reinforced polymer coating.
        2. Color: As selected by Architect from manufacturer's standard colors.
    b. Interior Face Sheet: 26 gauge thickness, with stucco embossed surface Light Mesa profile.
        1. Finish: Fluoropolymer two-coat system.
        2. Color: As selected by Architect from manufacturer's standard colors.
3. Panel Width: manufactuerer’s standard widths as shown on drawings
4. Panel Thickness: 2.5 inch.
5. Insulating Core: Polyisocyanurate with zero ozone depletion potential blowing agent
    a. Closed Cell Content: 90% or more as determined by ASTM D 6226
    b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM D 1621
    c. Shear Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM C 273
    d. Tensile Strength: As required to meet structural performance requirements and with a minimum of 16 psi as determined by ASTM D 1623

e. Minimum Density: 2.0 pcf as determined by ASTM D 1622
f. Thermal Resistance R-Value: 22.4 deg. F * hr * sq. ft./Btu per ASTM C 518 at 35 degrees Fahrenheit mean temperature.

6. Thermal Transmittance (U-factor): 0.045 Btu/hr * sq. ft. * deg. F as determined by ASTM C 1363 at 35 degrees Fahrenheit mean temperature. Tested specimen must include at least two engaged side joints.

2.4 METAL WALL PANEL ACCESSORIES

A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panels.

C. Panel Clips: ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, one-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

D. Panel Fasteners: Self-drilling or Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

E. Joint Sealers:

1. Sealants: Provide Tape Mastic Sealants, Non-skinning sealants, and Urethane Sealants in accordance with manufacturers' standards
2. Vertical Joint Gasket: Manufacturers standard EPDM gasket. Color: Black.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Fabricate metal panel joints configured to accept sealant providing weathertight seal.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

B. Exterior Face Sheet Coil-Coated Finish System

1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat.

a. Basis of Design: Metl-Span, Fluoropolymer.

C. Interior Face Sheet Coil-Coated Finish System

1. Fluoropolymer Two-Coat System: 0.2-mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat

a. Basis of Design: Metl-Span, Fluoropolymer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
2. Panel Support Tolerances: Confirm that metal panel supports are within tolerances acceptable to metal panel manufacturer but not greater than the following:
    a. 1/4 inch in 20 foot in any direction.
    b. 3/8 inch over any single wall plane.
    c. Girt Spacing 8 feet or more: 1/4 inch out only.
    d. Girt Spacing Less Than 8 feet: 1/8 inch out only.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

A. Concealed-Fastener Insulated Metal Panels with foam core: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to metal framing using screws, fasteners, sealants, and adhesives recommended for application by metal panel manufacturer.

1. Fasten metal panels to supports with the number and type of fastener(s) at each location as indicated on approved shop drawings, and at a support spacing and material recommended by the manufacturer.
2. Cut panels in field where required using manufacturer's recommended methods.
3. Provide weatherproof jacks for pipe and conduit penetrating metal panels.
4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.

C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealants.

D. Joint Sealers: Install sealants where indicated and where required for weatherproof performance of metal panel assemblies.

1. Seal panel base assembly, openings, panel head joints, and perimeter joints using sealants indicated in manufacturer's instructions.
2. Seal wall panel joints; apply continuously without gaps in accordance with manufacturer's written instructions, approved shop drawings, and project drawings.
3. Prepare joints and apply sealants per requirements of Division 07 Section.

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

B. Water-Spray Test: After completing a portion of a metal panel elevation including accessories and trim, test 2-bay area selected by Architect for water penetration, according to AAMA 501.2.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 074293
SOFFIT PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exposed fastener preformed metal soffit panel, with related metal trim and accessories, including flashings in connection with preformed metal wall panels.

1.2 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for structural steel framing supporting metal panels.
B. Division 05 Section "Steel Decking" for continuous metal decking supporting metal panels.
C. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
D. Division 07 Section "Sheet Metal Flashing and Trim" for requirements for reglets, gutters and flashings.

E. Division 07 Section "Joint Sealants" for field-applied Joint Sealants.

1.3 REFERENCES

A. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
B. AAMA 809.2 - Voluntary Specification Non-Drying Sealants.
C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
D. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
E. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
F. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
G. ASTM C 645 - Specification for Nonstructural Steel Framing Members.
H. ASTM C 920 - Specification for Elastomeric Joint Sealants.
I. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.

1.5 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under IAS AC 472 Part B.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

a. Product data, including certified independent test data indicating compliance with requirements.
b. Samples of each component.
c. Sample submittal from similar project.
d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
e. Sample warranty.
f. IAS AC 472 certificate.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
3. Approved manufacturers must meet separate requirements of Submittals Article.

C. Installer Qualifications: Experienced Installer with minimum of five years experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic, able to communicate with Owner, Architect, and installers, supervising work on site whenever work is underway.

1.6 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Indicate points of supporting structure that must coordinate with metal panel system installation.
2. Include data indicating compliance with performance requirements.
3. Include structural data indicating compliance with requirements of authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch-long section of each metal panel profile. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements, witnessed by a professional engineer.

B. Qualification Information: For Installer firm and Installer’s field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC 472.

D. Manufacturer's Warranty: Sample copy of manufacturer's standard warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instructions. Provide wood collars for stacking and handling in the field.

1.10 WARRANTY

A. Special Manufacturer’s Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.

B. Special Panel Finish Warranty: On Manufacturer’s standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within 25 years from date of Substantial Completion, including:

1. Fluoropolymer Two- Coat System:

a. Color fading in excess of [5] [10] Hunter units per ASTM D 2244.
b. Chalking in excess of No. [8] [6] rating per ASTM D 4214.
c. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: Metl-Span, an NCI Building Systems company; Houston TX. Tel: (877)713-6224; Email: info@metlspan.com; Web: www.metlspan.com.

1. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

C. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection as shown on structural drawings of the span with no evidence of failure.
3. Seismic Performance: Comply with ASCE 7, Section 9, "Earthquake Loads."

2.3 METAL PANEL MATERIALS

A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50, prepainted by the coil-coating process per ASTM A 755/A 755M.

2.4 MANUFACTURED PREFORMED PANELS

A. Soffit Panel:
1. Tapered-Rib-Profile, Exposed Fastener Metal Panels: Structural metal panel consisting of formed metal sheet with trapezoidal ribs, installed by lapping edges of adjacent panels.
   a. Basis of Design: Metl-Span, Style-Rib 7.2 Panel, https://metlspan.com/products/single-skin-wall-and-roof-panels/exposed-fasteners/style-rib/
   b. Coverage Width: 36 inches.
   c. Continuous Rib Spacing: 7.2 inches on center.
   d. Rib Height: 1-1/2 inch.
   e. Nominal Coated Thickness: 22 gage.
   f. Panel Surface: Smooth.
   g. Exterior Finish: Fluoropolymer two-coat system.
   h. Color: As selected by Architect from manufacturer's standard colors.

2.5 METAL PANEL ACCESSORIES

A. General: Provide complete metal panel assembly incorporating base, corner, and opening trims and miscellaneous flashings, in manufacturer's standard profiles and as indicated in drawings. Provide required fasteners, closure strips, support plates, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer.

1. Exposed Fasteners: Long life fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.

D. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:

1. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.

E. Steel Sheet Miscellaneous Framing Components: ASTM C 645, with ASTM A 653/A 653M, G60 hot-dip galvanized zinc coating.

2.6 FABRICATION

A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Panel Lengths: Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.

1. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable supports at recommended spacing to match installation requirements of metal panels.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with metal panel system installation.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, girts, furring, and other miscellaneous panel support members according to ASTM C 754 and manufacturer's written instructions.

B. Verify field measurements prior to fabrication.

3.3 METAL PANEL INSTALLATION

A. Install metal panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Panel Sealants: Install manufacturer's recommended tape sealant at panel sidelaps and endlaps.

C. Panel Fastening: Attach panels to supports using screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.

1. Fasten metal panels to supports at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
2. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
3. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

3.4 ACCESSORY INSTALLATION

A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.

B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.

1. Prepare joints and apply sealants per requirements of Division 07 Section Joint Sealants.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sheet metal for maintaining weather and water resistance of building enclosure.
   2. Edge roof flashing.
   3. Rain drainage.
   4. Sealant work related to sheet metal flashing and trim.
   5. Requirements for miscellaneous sheet metal integral with products and systems included under other Sections.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A653 - Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot- Dip Process.
   4. ASTM B32 - Solder Metal.
   5. ASTM B101 - Standard Specifications for Lead-Coated Copper Sheet and Strip for Building Construction.
   6. ASTM D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   7. ASTM D549 - Rosin in Paper and Paperboard.
   8. ASTM D4586 - Asphalt Roof Cement, Asbestos Free.
   9. SMACNA - Architectural Sheet Metal Manual.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with shop drawing, mockup, and warranty requirements of other Sections installed in conjunction with work of this Section.

1.04 ACTION SUBMITTALS

A. Shop Drawings: Fully detailed, large-scale drawings of all specially fabricated sheet metalwork. Identify material, thickness or weight, and finish.

B. Product Data: Manufacturer's catalog cuts for manufactured items including roof vents and reglets.

C. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

D. Samples: 6 inch by 12-inch section of typical exposed flashing with shop-applied finish.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification of fabricator, if requested by District's Representative.

1.06 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.07 QUALITY ASSURANCE

A. Qualifications:
   1. Installer shall have at least 5 years' documented experience in installation of sheet metal flashing and trim on projects of size and scope similar to this project.
   2. Workers shall be skilled and experienced in installing the type of sheet metal specified.

B. Mockups:
   1. First installed example of each installation condition, if not illustrated by building mockup, shall serve as a mockup for review and approval by District's Representative of workmanship, fit, and interface with adjacent construction.
   2. If requested, make modifications to mockups without additional charge to District.
   3. Do not proceed with remainder of installation until mockups have been approved.

1.08 FIELD CONDITIONS

A. Installation shall not proceed if an unusual condition is discovered or that will preclude work to be performed in accordance with the Drawings and Specifications. Immediately report this finding to the District's Representative for discussion and resolution.

1.09 GUARANTEE AND WARRANTY

A. Furnish District with a written 2-year guarantee agreeing to repair or replace work that fails in materials or workmanship. Failure includes failure to perform as specified and/or deterioration of finish or construction in excess of that to be expected under normal weathering.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Industry Standards:
   1. Conform to applicable provisions of the "Architectural Sheet Metal Manual" of the Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA Manual), except where more stringent requirements are specified or shown.
   2. Conform to applicable provisions of NRCA "Roofing and Waterproofing Manual."

B. Installed flashing and sheet metalwork shall be weathertight.

C. At roofing applications, comply with specified standards as applicable. Roof edge flashing shall comply with ANSI/SPRI ES-1 and FM 1-90.

D. Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement resulting from the maximum ambient and surface temperatures expected, and exposure to weather without failure due to defective manufacturer, fabrication,

installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

E. Provide materials that are compatible with one another under conditions or service and application required, as demonstrated by testing and field experience.

2.02 SHEET METAL

A. General:
   1. Thickness: As required by SMACNA for specific conditions and as shown on Drawings but not less than 24-gage.
   2. Thickness at continuous cleats shall be minimum 20-gage.

B. Metallic-Coat Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, Z275 (G90) coating designation; structural quality.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Class AZM150 coating designation, Grade 275 (Class AZ50 coating designation, Grade 40); structural quality; “Zincalume,” “Galvalume,” or “Zintro-Alum” manufactured under license from BIEC International, Inc., Vancouver, WA.

C. Aluminum: ASTM B209, alloy 3003, 0.032 inch thick, except as otherwise indicated or recommended by SMACNA.

D. Stainless Steel:
   1. Sheet: ASTM A240 / A240M or ASTM A666, Type 304, dead soft, fully annealed.
   2. Finish: 2D (dull, cold rolled).
   3. Thickness: 24 gage unless otherwise noted on the Drawings.

2.03 ADDITIONAL MATERIALS AND COMPONENTS

A. Fasteners: Hot-dip galvanized or 300 series alloy stainless steel.
   1. Pop rivets, made from same type material as metals to be fastened, may be used for metal-to-metal connections when future disassembly is not required and where not exposed to view.
   2. Provide stainless steel/EPDM washers at exposed fastener locations.

B. Solder:
   1. For Stainless Steel: ASTM B32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
   2. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

C. Slip Sheet:
   1. Rosin-sized, unsaturated building paper, 4-6 pounds per 100 square feet; FS UU-B-790, Type I, Grade A.
   2. Inorganic, high-performance, non-woven, non-perforated, spunbonded polyolefin; DuPont “Tyvek CommercialWrap.”

D. Pressure Bars and Termination Bars: Stainless steel or aluminum.

E. Draw Bands: Type 316 stainless steel sheet with Type 316 stainless steel screw.

F. Sealants:
   1. Exposed Joints: Low modulus, high performance, one-part polyurethane; Type JS-1.
   2. Concealed Joints: Sealant Type II, ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy-bodied for hooked-type expansion joints with limited movement.
   3. Concealed Sealant Tape: Sealant Type IV; pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, ton-toxic, non-staining tape 1/2 inch wise x 1/8 inch thick.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

H. Manufactured Reglets: 24-gage galvanized steel unless otherwise indicated on the Drawings; Fry Reglet Corp. “Springlok” Flashing System.
   1. Finish: Manufacturer's gray epoxy primer; exposed portions shall be field finish painted as specified in Section 09 90 00, "Painting and Coating."
   2. Provide the manufacturer's following accessories.
      a. "P" Vinylok Flashing Retainer where counterflashing is not provided by manufacturer.
      b. Mitered and sealed corners.

I. E. Pipe Penetration Curbs: Pipe Penetration Curbs and Covers, locate at grouped pipe penetrations serving mechanical unit locations. Size as recommended by manufacturer to accommodate piping indicated and to minimize number of curb penetrations required. Field located to avoid conflicts with other systems.
   1. Finish: Field Painted.
   2. Insulated Curb for Non-Insulated Roof Decks: Fully mitered 3 inch cant, welded 18 gauge galvanized steel shell and base plate, 1-1/2 inch thick 3-pound density rigid insulation, factory installed 2 x 2 wood nailer, reinforcing on sides 36 inches and greater.
      a. ThyCurb Model TC-2.
   3. Graduated Pipe Boot Cover: ABS thermoplastic korad acrylic cover, graduated boots molded of weather-resistant Plastisol and (2) stainless steel pipe clamps per boot.
      a. ThyCurb Model TCC-5.
   4. Manufacturer:
      a. Thybar Corp/ThyCurb:. www.thybar.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FABRICATION

A. General:
   1. Obtain field measurements for accurate fit before proceeding with shop fabrication.
   2. Fabricate cleats and attachment devices from the same material as accessory being anchored.
   3. Exposed edges of sheet metal flashing shall be folded and hemmed.
   4. Fabricate inside and outside corners, intersections, and complex flashing conditions in shop with folded, constructed, mechanically fastened, and soldered joints.

B. Shop-fabricate flashing, trim, expansion joints, and similar items to comply with profiles and sizes shown and in accordance with standard details shown in "Architectural Sheet Metal Manual" by SMACNA.
   1. Finished work shall be strong and rigid, neat in appearance and free from defects.
   2. Surfaces shall be smooth and free from warping or buckling.
   3. Seams and joints shall be kept to a minimum.
   4. Metal sheets in straight runs shall be made up of lengths of not less than 8 feet unless shorter lengths are required to meet thermal expansion requirements.
   5. Joints exposed to view, such as storefront flashing, shall be flush butt joints separated by a 3/8-inch space with backing plate bedded watertight in sealant. Other joints shall be lapped unless otherwise shown on Drawings.

2.05 FINISHES

A. Factory Priming:
   1. Galvanized sheet metal shall receive bonderizing pretreatment before priming.
   2. Pretreat and prime in accordance with the requirements specified in Section 05 5000, “Metal Fabrications.” Where it is not possible to provide shop priming, pretreatment in field prior to priming for sheet metal not capable of being shop primed shall comply with these requirements.
   3. Field-finish as specified in Section 09 90 00, “Painting and Coating.”

B. Anodized Finish on Exposed Aluminum: Architectural Class I clear anodic coating conforming to AA-M12C22A41, unless otherwise noted.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:
   1. Comply with details and profiles indicated on Drawings and SMACNA "Architectural Sheet Metal Manual" recommendations for installation of the work.
   2. Conceal fasteners, except those specifically indicated on the Drawings to be exposed.
   3. Conceal reinforcement within finished assembly.
   4. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, slip sheet, or other permanent separation as recommended by SMACNA.
   5. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated, and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

B. Flashings:
   1. Install flashings and counterflashings where shown or required to provide watertight protection.
   2. Install specified self-adhesive flashing as specified in Section 07 65 00, “Self-Adhering Sheet Flashing (SAF),” under coping and elsewhere as shown.
   3. Counterflashing:
      a. Coordinate installation of counterflashing with installation of roofing membrane termination.
      b. Extend counterflashing 4 inches over roofing.
      c. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant.
      d. Secure in a waterproof manner by means of anchor and washer spaced at 36 inches centers maximum.
   4. Pipe or Post Counterflashing Flashing:
      a. Install counterflashing umbrellas with close-fitting collar with top edge flaired for elastomeric sealant extending minimum of 4 inches over lead flashing or waterproofing membrane.
      b. Install stainless steel draw band and tighten.
   5. Penetration Flashing Through Base Flashing:
      a. Provide prefabricated collar flashing soldered watertight with minimum 4 inch flanges.

C. Gutters:
   1. Lap joints at least 6 inches in direction of flow. Secure thoroughly and seal watertight.
   2. Expansion joints in gutters shall be butt type. Install only at midpoint in run of gutter.
   3. Fasten or secure to structure in such a way as to permit free movement for expansion and contraction.

D. Downspouts:
   1. Install exposed downspouts in sections not less than 8 feet long, except where shorter length is required.
   2. Set downspouts plumb and to configuration shown on Drawings.
   3. Join lengths of downspout by telescoping end of upper length 3/4 inch minimum into lower length.
   4. Provide straps to secure both ends of joining lengths.

E. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.02 FIELD QUALITY CONTROL

A. Maximum Deviation from Alignment When Erected: 1/4 inch in 20 feet.

B. District may hire an inspector perform inspections and prepare reports to confirm that installed work complies with specified requirements.

C. Remove and replace system components where inspection or test results indicate that work does not comply with specified requirements.

D. Additional testing and inspection may be required to verify that replaced or additional work complies with specified requirements.

3.03 CLEANING AND TOUCH-UP

A. Flashings and counterflashings shall be replaced if exposed fasteners or damage exists through the metal flashings and where deterioration or damage is beyond successful repair by finish touchup or similar minor repair procedures.

B. If applicable, touch up shop-applied primer on galvanized sheet metal, and paint as specified in Section 09 90 00, "Painting and Coating."

END OF SECTION

SECTION 078400
FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Through-penetration firestop systems.
   2. Fire-rated joint systems.

B. Related Requirements:
   1. Gypsum Board: Section 09 29 00; gypsum wallboard fireproofing at structural members.
   2. Divisions 21 through 28: Infrastructure systems requiring firestopping.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed in accordance with specified requirements.
   2. Sequence work to permit firestopping to be installed after completion of penetrating item installation but prior to covering or concealing of openings.

1.02 ACTION SUBMITTALS

A. Shop Drawings: Manufacturer's UL-approved assembly drawings if they reflect actual job conditions.
   1. For job conditions where no clearly defined UL-approved assembly exists, provide an engineering judgment from manufacturer.
   2. Engineering judgments shall follow requirements set forth by the International Firestop Council.

B. Product Data: Manufacturer's specifications and installation instructions for all materials and prefabricated devices, providing descriptions sufficient for identification at the jobsite.
   1. Instruction details shall reflect actual job conditions.
   2. Where available, include aging data for intumescent products.

C. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.03 INFORMATIONAL SUBMITTALS

A. Manufacturer's certification or certified laboratory test report stating that materials or combination of materials meet requirements specified in ASTM E814 and are so classified in UL's Building Materials Directory.

B. UL Certificates of Compliance.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Firestopping installation shall meet requirements of Underwriters Laboratories Inc. (UL) Test UL 1479, "Fire Tests of Through-Penetration Firestops," or ASTM E814 and UL 2079.
   2. Materials shall meet requirements of NFPA 101, "Life Safety Code" and CEC.

B. Installer Qualifications: Experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.

C. At Design-Builder's option, work under this Section may assigned to a single qualified installer or be divided among various trades, subject to limitation that same products for each firestopping system are used throughout and each installer meet qualification requirements specified in this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened packages or containers clearly identifying manufacturer's names, brand designations, product descriptions, applicable standards, lot numbers, and test or rating labels.

B. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

1.06 FIELD CONDITIONS

A. Provide masking and drop cloths during installation to prevent firestopping materials from contaminating adjacent surfaces.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. General:
   1. Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and passage of smoke and other gases.
   2. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E84.
   3. Materials shall be compatible with each other and with other specified items with which they may come in contact and shall not cause corrosion of penetrating items.
   4. Materials shall be free of solvents, asbestos, or PCBs, and shall be nontoxic to human beings at all stages of application and during fire conditions.
   5. Firestopping shall remain sufficiently flexible after installation to accommodate expected vibration and movement between penetrating items and rated building components or assemblies or between adjacent building components or assemblies at joint systems, without affecting adhesion or integrity of system.
   6. Materials shall not shrink noticeably after installation.
   7. Rating of firestopping materials or system shall in no case be less than rating of rated floor or wall assembly.
   8. Caulk, foam, mortar, and putty materials shall be autobonding to permit changes to penetrating items.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings as determined in accordance with ASTM E814 but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined in accordance with ASTM E814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. Locations where T-rated assemblies are required include, but are not limited to, where penetrating items are larger than a 4-inch-diameter nominal pipe or 16 square inches in overall cross-sectional area.

D. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/square foot at both ambient temperatures and 400 degrees F.

E. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per UL 2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

F. For firestopping exposed to view, traffic, moisture, and physical damage, provide assemblies that do not deteriorate when exposed to these conditions.

2.02 FIRESTOPPING MATERIALS

A. General:
   1. Materials listed below are not necessarily all-inclusive, nor are all materials listed necessarily required to be used.
   2. Although several manufacturers are listed for each type of firestopping and listed manufacturers also vary for each Type, Design-Builder shall develop systems for firestopping using approved systems from a single manufacturer unless products for required systems are not available from the selected manufacturer.

B. General:
   1. Materials listed below are not necessarily all-inclusive, nor are all materials listed necessarily required to be used.
   2. Although several manufacturers are listed for each type of firestopping and listed manufacturers also vary for each Type, Design-Builder shall develop systems for firestopping using approved systems from a single manufacturer unless products for required systems are not available from the selected manufacturer.

C. Job-Mixed Vinyl Compound: “USG Firecode Compound” by United States Gypsum Co., "Gold Bold Sta-Smooth FS 90 Fire-Shield Compound," or equal.

D. Firestop Mortar: Prepackaged dry mix of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar; Hilti FS 637 “Firestop Mortar," or equal.

E. Non-intumescent Firestop Sealant: One-part silicone elastomer; Hilti CP 601S “Elastomeric Firestop Sealant," or equal.

F. Intumescent Firestop Sealant: Hilti "FS-One," or equal.

G. Mastic Firestop Sealant: Single component, water based, mastic grade; Rectorseal "Metacaulk 1100" or equal.

H. Firestop Foam: Two-component silicone elastomer; Hilti CP 620 "Fire Foam," or equal.
   1. Forming and Damming Materials, As Required: Mineral fiberboard or as selected by installer.
   2. Primer, sealant, and solvent cleaner as recommended by foam manufacturer.

I. Intumescent Fire Blocks: Hilti "FS-657" or equal.

J. Flexible Firestop Spray Coating: Sprayable water-based coating; designed to form a flexible seal over mineral fiber firesafing; Hilti CP 672 "Speed Spray," or equal.

K. Intumescent Putty and Putty Pads (for Use at Electric Boxes): Hilti CP 617 “Firestop Putty Pads" in required lengths and CP 618 “Firestop Putty Sticks," or equal.

L. Intumescent Pipe Wrap: Hilti CP 645, 648E or 648S "Firestop Wrap Strip," or equal.

M. Electrical Box Treatment: 3M "Fire Barrier Moldable Putty Pads," Hevi-Duty Nelson Products "FSP Firestop Putty Pads," International Protective Coatings Corp. "Flamesafe FSP 1077 Firestop Pads," or equal.

2.03 FIRESAFING, ACCESSORIES, AND ADDITIONAL MATERIALS

A. Types:
   1. Unfaced Mineral Fiber: 4 pcf, suitable for friction fit in voids. Melt point 2000 degrees F minimum, ASTM C24. Ceramic or cementitious-blend fiber is also approved. Do not use glass fiber.
   2. Foil Faced Mineral Fiber: Same as unfaced mineral fiber but with aluminum foil facing on one side.
   3. Thermal Conductivity: 0.25 to 0.23 k-value per ASTM C518.
   4. Flammability:
      a. Noncombustible as defined by NFPA Standard 220 when tested in accordance with ASTM E136.
      b. Surface-Burning Characteristics:
         1) Flame Spread: 15 (10 to 25 with foil facing).
         2) Fuel Contributed: 0 (5 with foil facing).
         3) Smoke Developed: 0.

B. Other Facing and Backing Materials: As recommended by firestopping manufacturer. Use fire resistive material where possible.

2.04 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive firestopping. Remove dirt, grease, oil, loose materials, rust and other substances that may affect bond, installation, and fire resistance.

3.02 INSTALLATION

A. Install backing materials, forms, clips, and other items as required to hold firestopping and firesafing in place.

B. Prepare surfaces and install firestopping sealants in accordance with ASTM C1193 and manufacturer's printed instructions, except where more stringent requirements are shown or specified. Exposed sealant shall be trowelled smooth.

C. Firestopping and firesafing shall be installed to completely fill void spaces regardless of geometric configuration and to maintain integrity over entire area to form a continuous fire stop. Do not use unfaced mineral fiber by itself for firestopping purposes.

D. Firestop wall penetrations on both sides.

E. At sound-rated fire-rated construction, use only permanently resilient firestopping materials, and seal airtight.

F. Exposed sealant shall be troweled smooth.

3.03 ELECTRICAL BOXES AND UTILITY OUTLETS

A. Steel electrical outlet boxes on opposite sides of walls requiring protected openings shall be separated by a horizontal distance of 24-inches.

B. Steel electrical outlet boxes which occur in combination with outlet boxes of any size such that the aggregate area of unprotected outlet boxes exceeds 100-square inches in any 100-square feet of wall area shall be protected by an approved material or detail to decrease the aggregate area of unprotected utility boxes to less than 100-square inches in any 100-square feet of wall.

C. Steel electrical outlet boxes which exceed 16-square inches in area shall be protected with specified electrical box treatment.

D. Utility and electrical outlets or boxes shall be securely fastened to the stud or framing of the wall assembly.
   1. The opening in the gypsum board shall be cut so that the clearance between the box and the gypsum board does not exceed 1/8-inch.
   2. In smoke partitions, fill the 1/8-inch gap with an approved fire-rated sealant.

E. See additional requirements specified in Section 09 8200, “Acoustical Insulation and Sealants.”

3.04 FIELD QUALITY CONTROL

A. Verify that firestopping is properly installed before concealing or enclosing firestopped areas.

B. Firestopping shall remain accessible until inspection and approval by District’s Representative and governing authorities.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior sealants and calking work required to weatherproof the building.
   2. Interior sealants and calking.

B. Related Requirements:
   1. Glazing: Section 08 80 00; glazing sealants.
   2. Acoustical Insulation and Sealants: Section 09 82 00; acoustical sealants.

1.02 REFFERENCES

A. ASTM C834, 2014 - Latex Sealing Compounds.

B. ASTM C881, 2014 - Epoxy-Resin Base Bonding Systems for Concrete.

C. ASTM C882, 2013 - Test Method for Bond Strength of Epoxy - Resin Systems Used with Concrete by Slant Shear.

D. ASTM C920, 2014 - Elastomeric Joint Sealants.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications, recommendations, and installation instructions, including cleaning of joint surfaces, for each sealant material to be used.

B. Samples: Color selection for each product exposed to view; manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available.

C. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of qualifications for applicator of exterior sealant.

B. Results of field adhesion testing.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranty.

B. Manufacturer’s written instructions for recommended maintenance practices, including schedule.

1.06 QUALITY ASSURANCE

A. Material Compatibility: Sealant materials shall be compatible with one another and with other specified materials, under conditions of service and application required.

B. Source Limitations: Obtain each kind of joint sealant from a single source manufacturer.

C. Installer Qualifications for Exterior Sealants: A firm experienced in installing sealants similar to that those indicated for this Project, with a record of successful in-service performance, and acceptable to material manufacturers.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with manufacturer's labels. Labels on delivered materials shall show manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.08 FIELD CONDITIONS

A. Do not proceed with sealant installation under adverse conditions such as when ambient or substrate conditions are outside limits recommended by manufacturer, wet substrates, joint widths are not within tolerance, or contaminants have not been removed from substrates.

1.09 GUARANTEE AND WARRANTY

A. General:
   1. Repair or replace joint sealants that fail to achieve airtight and watertight seal or otherwise fail to perform as intended because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining, loss of adhesion or cohesion, or do not cure within the specified warranty periods.
   2. Extended warranties specified in this Section exclude deterioration or failure of joint sealants from the following:
      a. 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.
      b. Disintegration of joint substrates from natural causes exceeding design specifications.
      c. Mechanical damage caused by individuals, tools, or other outside agents.
      d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

B. Furnish District with a written 2-year guaranty agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

C. Manufacturer: Furnish District with manufacturer's written 20-year warranty for sealant Types 1A and 1B agreeing to furnish sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty shall include failure due to loss of adhesion, weather seal. In addition, Type 1B sealant warranty shall include staining.

2. Contractor shall be responsible for scheduling, arranging, and providing any print review and testing required by manufacturer as a condition for issuance of its warranty.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Material Compatibility: Sealant materials shall be compatible with one another and with other specified and existing materials, under conditions of service and application required.

2.02 SEALANT MATERIALS

A. Colors:
   1. Concealed Material: Any of manufacturer's standard colors.
   2. Exposed Material: Manufacturer's standard colors, to be selected by the Architect.

B. Type 1A - Sealant for General Exposed Exterior Use: One part, neutral cure, gun-grade silicone conforming to ASTM C920, Type S, Grade NS, Class 25; Dow Corning "795 Building Sealant," or equal.

C. Type 1B - Sealant for Exterior Use at Concrete and Other Porous Surfaces: Non-bleed, reduced-stain type; one part silicone conforming to ASTM C920, Type S, Grade NS, Class 25; Dow Corning "765 SMS," or equal.

D. Type 2 - Concealed Bedding Conditions: One-part butyl-rubber calk conforming to FS TT-S-001657, Type I; Pecora "BC158," or equal.

E. Type 3 - Exterior and Interior Horizontal Joints Subject to Pedestrian Traffic: Two-part polyurethane conforming to ASTM C920, Class 25, Type M, self-leveling; Pecora "Urexpan NR-201," or equal.

F. Type 4 - Interior Nonwet Areas: One-component acrylic latex water-based sealant conforming to ASTM C834; “Tremco "Acrylic Latex," or equal.

G. Type 5 - Interior Wet Areas: One-part mildew-resistant silicone rubber conforming to ASTM C920, Type S, Class 25, Grade NS; Dow-Corning "786," or equal.

H. Type 6 - Exposed Sealant at Metal Flashing: Single-component, polyurethane conforming to ASTM C920, Type S, Class 25, Grade NS; Sika “Sikaflex 15LM," or equal, acceptable to metal panel manufacturer.

2.03 MISCELLANEOUS SEALANT MATERIALS

A. Sill Sealer: 3/8-inch thick closed cell polyethylene foam with a self-adhering waterproof membrane facing; “Protector Premium Energy Sill Sealer” by Protecto Wrap Company, or equal.

B. Perimeter Gap Sealant: Gun-dispensed, aerosol foam polyurethane or polyisocyanurate type conforming to ASTM C1620; Hilti “CF 810/812,” or equal.

C. Fiber Expansion Joint Material: Preformed cellular fiber complying with ASTM D1751, 1/2 inch thick unless otherwise noted; "SealTight Fiber Expansion Joint Filler" by W.R. Meadows, or equal.

D. Additional Sealant Materials: As specified in the respective Specification Sections.

2.04 SEALANT ACCESSORIES

A. Joint Primer/Sealer: As recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Sealant Backer Rod: Compressible, rod-stock, polyethylene foam; non-gassing, polyethylene-jacketed polyurethane foam; butyl-rubber foam; neoprene foam; or other flexible, permanent, durable, non-absorptive, closed-cell material as recommended for compatibility with sealant by sealant manufacturer.

C. Cleaner for Nonporous Surfaces: Nonstaining chemical cleaner acceptable to manufacturer of sealer and backing materials, harmless to substrates and adjacent nonporous materials.

D. Masking Tape: Nonstaining, nonabsorbent, compatible with joint sealants and adjacent surfaces.

E. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer. Provide self-adhesive tape where applicable.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify joint dimensions and conditions of installation are in conformance with sealant manufacturer’s recommendations.

B. Clean joint surfaces immediately before installation of sealant.
   1. Remove dirt, insecure coatings, moisture, and other substances that would interfere with bond of sealant.
   2. Etch concrete joint surfaces as recommended by sealant manufacturer.
   3. Use VOC compliant cleaning agent to clean all joint surfaces.
   4. Wipe joints free of cleaning materials.

3.02 INSTALLATION OF ELASTOMERIC SEALANTS

A. General:
   1. Comply with manufacturer's printed instructions, except where more stringent requirements are shown or specified.
   2. Comply with ASTM C1193 for installation of elastomeric joint sealants.

B. Prime or seal joint surfaces as recommended by sealant manufacturer.
   1. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
   2. Prime anodized aluminum and painted surfaces using primer recommended by sealant manufacturer, unless sealant manufacturer certifies in writing, that primer is not required.

C. Install sealant backer rod for elastomeric sealants, except where recommended to be omitted by sealant manufacturer for application shown.

D. Install bond-breaker tape wherever backer rod is not used and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Use only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides.
   1. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
   2. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

3.03 INSTALLATION OF ADDITIONAL SEALING MATERIALS

A. Install sill sealer on top of foundation walls under sill plate to close gaps between concrete and sill plate.

B. Aerosol Foam: Install at exterior wall crevices, penetrations and cracks in accordance with manufacturer’s instructions. Fill spaces completely to a uniform monolithic density without voids.

3.04 CLEAN AND CURE

A. Clean adjoining surfaces to eliminate excess sealant.

B. Cure sealants in compliance with manufacturer's instructions and recommendations to obtain high early-bond strength, internal cohesive strength, and surface durability.

END OF SECTION

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SECTION 079500
EXPANSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Architectural expansion joint systems for building interiors.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for cast-in architectural-joint-system frames furnished, but not installed, in this Section.

2. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal wall joint systems.

3. Division 07 Section "Firestopping for liquid-applied joint sealants in fire-resistive building joints.

4. Division 07 Section "Joint Sealants" for liquid-applied joint sealants.

1.02 SUBMITTALS

A. Shop Drawings: Provide the following for each joint system specified and obtain approval prior to fabrication and shipment of materials to the job site:

1. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blockout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Product Data: Submit copies of manufacturer’s latest published literature for materials specified herein for approval, and obtain approval before materials are fabricated and delivered to the site. Data to clearly indicate movement capability of cover assemblies and suitability of material used in exterior seal for UV exposure.

C. Samples for Initial Selection: For each type of joint system indicated.

1. Include manufacturer's color charts showing the standard range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Certificates – Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Approved by manufacturer.

B. Source Limitations: Obtain all architectural joint systems through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Loading Characteristics: Standard loading refers to covers that are capable of withstanding up to 500 lb. point loads. Heavy duty refers to covers that are capable of withstanding up to 2000 lb. point loads.

E. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 and/or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction. Fire rating not less than the rating of adjacent construction.

F. Manufacturer to provide 5 year warranty for all joint covers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design – manufactured by Construction Specialties subject to compliance with requirements listed. The Expansion Joint Covers and related materials herein specified and indicated on the drawings shall be manufactured by: Construction Specialties, 3 Werner Way, Lebanon, NJ 08833. Tel. 800.233.8493. Email: cet@c-sgroup.com.

B. Other manufacturers must be approved equal by Architect/Owner.

2.02 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

2. Mill Finish: AA-M10

3. Class II, Clear Anodic Finish: AA-M12C22A31 complying with AAMA 611.

B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

D. Fire Barriers: Any material or material combination, when fire tested to UL2079 standards after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.

1. Joint Size 1” -4”- use Reflex® Fire barrier

2. Joint Size 5” -30”- use FB-17 Fire barrier

F. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.03 ARCHITECTURAL JOINT SYSTEMS, GENERAL

A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.

B. Design architectural joint systems for the following size and movement characteristics:

1. Nominal Joint Width: As indicated on Drawings
2. Maximum Joint Width: As indicated on Drawings
3. Minimum Joint Width: As indicated on Drawings
4. Lateral Shear Movement Capability: As indicated on Drawings

2.04 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

A. Wall-to-Wall Joint Systems:

1. Basis-of-Design Product: Construction Specialties, Inc. model SFW

2. Type: Vertical cover plate – self centering.

    a. Exposed Metal: Aluminum.
        1) Finish: Class II, clear anodic or available Kynar® color options.

3. Gasket: Duroflex Gasket – single durometer – 80 Shore A, ASTM D2000.

4. Turnbar:
    a. Material – C1075 Blue temper Spring Steel
    b. Hardness – RC 44 – 47
    c. Finish – “A” Coating (corrosion protection)

5. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

B. Wall Corner Joint Systems:

1. Basis-of-Design Product: Construction Specialties, Inc. model SCW

2. Type: Vertical cover plate – self centering.

    a. Exposed Metal: Aluminum.
        1) Finish: Class II, clear anodic. Or available Kynar® color options.

3. Gasket: Duroflex Gasket – single durometer – 80 Shore A, ASTM D2000.

4. Turnbar:
    a. Material – C1075 Blue temper Spring Steel
    b. Hardness – RC 44 – 47
    c. Finish – “A” Coating (corrosion protection)

5. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

C. Floor-to-Floor Joint Systems:

1. Basis-of-Design Product: Construction Specialties, Inc. model SJPFR

2. Type: Cover plate – self centering.

    a. Exposed Metal: Aluminum.
        1) Finish: C/S #3 brushed, non-slip finish.

3. Cover Plate Design: Recessed to accept field-applied finish materials.

a. Recess Depth: 1/8” minimum.

4. Attachment Method: Mechanical anchors.

5. Turnbar
   a. Material – C1075 Blue Temper Spring Steel
   b. Hardness – RC 44-47
   c. Finish – “A” Coating (Corrosion Protection)

6. Load Capacity: Heavy duty.

7. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

D. Floor-to-Wall Joint Systems:

1. Basis-of-Design Product: Construction Specialties, Inc. model SJPFRW

2. Type: Cover plate – self centering.

   a. Exposed Metal: Aluminum.
      1) Finish: C/S #3 brushed, non-slip finish.

3. Cover Plate Design: Recessed to accept field-applied finish materials.

   a. Recess Depth: 1/8” minimum.

4. Attachment Method: Mechanical anchors.

5. Turnbar
   a. Material – C1075 Blue Temper Spring Steel
   b. Hardness – RC 44-47
   c. Finish – “A” Coating (Corrosion Protection)

6. Load Capacity: Heavy duty.

7. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and blockouts where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.

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

3.02 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.03 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.

3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.

4. Locate in continuous contact with adjacent surfaces.

5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.

2. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.

E. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.04 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hollow metal doors and frames.

B. Related Requirements:
   1. Wood Doors: Section 08 14 00.
   2. Door Hardware: Section 08 71 00.
   3. Glazing: Section 08 80 00.
   4. Painting and Coating: Section 09 90 00.

1.02 COORDINATION

A. Hardware supplier shall furnish steel door and frame manufacturer with accepted hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation. Preparation includes sinkages and cutouts for mortise and concealed hardware.

1.03 ACTION SUBMITTALS

A. Schedule and Shop Drawings:
   1. Cover each type of door, frame, and frame condition.
   2. Include the following specific information:
      a. Elevation of doors and frames.
      b. Jamb and head details.
      c. Hardware preparation locations and reinforcing details of doors and frames.
      d. Door and frame location schedule.
      e. Complete door and frame descriptive nomenclature.
      f. Material description and gages.
      g. Meeting stile details.
      h. Methods of anchorage.
      i. Glass molding details.
      j. ouver details.
   3. Use same reference numbers for details and openings as those indicated on Drawings.

B. Product Data: Manufacturer's technical data substantiating that products comply with specified requirements.

C. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 INFORMATIONAL SUBMITTALS

A. Test Reports for each type of fire-rated hollow metal door and frame assembly if not included as part of product data submittal.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide packaging as cardboard or other containers, separators, banding, spreaders, and paper wrappings in order to protect items during transit and Project site storage.

B. Inspect products upon delivery for damage. Minor damage may be repaired, provided that refinished items are equal in all respects to new work and acceptable to the Architect. Otherwise, remove and replace damaged items as directed.

C. Store doors upright in a protected dry area on a raised platform at least 1 inch off the ground. Provide blocking between units so as to provide air circulation.

1.06 FIELD CONDITIONS

A. Post-Set Frames: Prepared openings shall be properly located and sized, plumb and square. Do not force-fit frames into improperly constructed openings.

B. Preset Frames: Wall/partition and frame locations shall be accurately marked before frames are erected.

1.07 WARRANTY

A. Manufacturer: In addition to the Design-Builder’s Contract warranty, furnish District with manufacturer's warranty for doors and frames against defects in materials and workmanship including twisting, buckling or warping. Warranty shall cover replacement of door plus costs of hanging and finishing.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames: Steelcraft, Ceco, Curries, Curries Company, Security Metal Products, or equal SDI Certified manufacturer

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Steel doors and frames shall comply with ANSI A250.8.

B. Work shall meet applicable requirements of the Hollow Metal Manufacturers Association (HMMA), a Division of the National Association of Architectural Metal Manufacturers (NAAMM).

C. Fire-Rated Assemblies: Provide fire-rated steel doors and frames investigated and tested as part of a fire door assembly complete with type of fire door hardware to be used.
   1. Identify each fire-rated door and frame with permanent, metal labels, in accordance with NFPA Standard 252, UL 10C, and CBC, from approved testing and inspection agency, indicating applicable fire rating.
   2. Fire rated assemblies shall be protected by tight fitting smoke and draft control assemblies, and include door and frame with fire rating label followed by a letter “S” for smoke and draft control rating.
   3. Construct and install assemblies in such a manner as to comply with NFPA Standard No. 252, or UL 10C and NFPA 80 and as specified herein.
   4. Labels: Place fire rating labels where visible when doors and frames are in installed, open positions.

D. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
   1. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.Fire Ratings: As scheduled on the Drawings.

2.03 MATERIALS AND COMPONENTS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A568 and ASTM A1011.

B. Cold-Rolled Steel Sheets: Commercial-quality carbon steel complying with ASTM A568 and A1008, exposed, matte finish, oiled.

C. Galvanized Steel Sheets: Commercial-quality zinc-coated carbon steel complying with ASTM A653 with A60 or G60 zinc coating.

D. Supports and Anchors: 24” o.c. maximum, Not less than 18-gage galvanized sheet steel.
   1. 2 anchors per head frame minimum
   2. 3 anchors per head frame for widths greater than 42”

E. Frame Anchors:
   1. Typical: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   2. Anchors Built Into Exterior Walls: Steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units.

G. Shop-Applied Paint: Rust-inhibitive primer, either air dried or baked on, suitable as a base for specified finish paints.

2.04 FABRICATION - GENERAL

A. Fabricate hollow metal units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable.

B. Fabricate steel doors and frames to required profiles and sizes by forming with edges straight and sharp.

C. Exterior doors and frames shall be fabricated from specified galvanized-steel sheets.

D. Fit and fabricate accurately with corner hairline joints and all surfaces free from warp, wave, buckle, and other defects.

E. Welding:
   1. In accordance with AWS standards for high-grade hollow metal work.

2. Grind exposed beads smooth.

F. Fabricate exposed faces of doors only from cold-rolled steel.

G. Fabricate frames from either cold-rolled or hot-rolled steel (at fabricator's option).

H. Unless otherwise indicated, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

I. Shop Painting: Comply with ANSI/SDI A250.10.

2.05 STEEL FRAMES

A. Gages:
   1. Interior:
      a. Frames in Openings 4'-0" or Less in Width: 16 gage unless thicker gage is included in UL test procedure for rated frames.
      b. Frames in Openings over 4'-0" Width: 14 gage.
   2. Exterior: 14 gage, galvanized (A60 minimum).

B. Design and Construction:
   1. Factory-assembled and weld into a single unit by frame manufacturer. Saw-miter or cope and tab frame miters, and continuously weld at return, face, rabbet, and stop. Knocked-down frames will not be accepted.
   2. Jamb depths, trim, profile and backbends shall be as shown on Drawings.
   3. Minimum depth of stops shall be 5/8 inch unless otherwise noted. Drill stops for silencers: three in strike stops for single swing doors, two in head stops for double swing doors.
   4. Profile bottom of jamb to contour of concrete at change in floor elevation occurring within jamb width.
   5. Floor Anchors:
      a. Floor anchors shall be securely welded inside each jamb for floor anchorage.
      b. Where required, provide adjustable floor anchors, providing not less than 2 inch height adjustment.
      c. Minimum thickness of floor anchors shall be 14 gage.
   6. Jamb Anchors:
      a. Frames for installation in stud partitions shall be provided with steel anchors of suitable design, not less than 18 gage thickness, securely welded inside each jamb as follows:
         1) Frames up to 7'-6" High: 4 anchors.
         2) Frames 7'-6" to 8'-0" High: 5 anchors.
         3) Frames over 8'-0" High: 5 anchors plus one additional for each 2 feet or fraction thereof over 8'-0" inches.
      b. Provide ceiling struts for fire rated frames where required by ANSI/UL 63.
   7. Frames shall be provided with a steel spreader temporarily attached to the feet of both jambs to serve as a brace during shipping and handling.

2.06 HOLLOW METAL DOORS

A. ANSI/SDI Classification:
   1. Exterior: Level 3 and Physical Performance Level A, Model 2, extra heavy-duty seamless construction.
      a. Face sheets shall be minimum 0.053 inches (16-gage).
      b. Insulated for a minimum "U" value of 0.24 except where opening into unconditioned spaces.

2. Interior Non-Fire-Rated, if Used: Level 2 and Performance Level B, Model 2, heavy-duty seamless construction.
    a. Face sheets shall be minimum 0.042 inches (18-gage).
    b. Core: Honeycomb laminated to the inside of both face sheets.
3. Interior Fire-Rated: Level 2 and Performance Level B, Model 2, seamless construction.
    a. Face sheets shall be minimum 0.042 inches 18 gage) unless otherwise required for required rating.
    b. Core: Mineral fiber or as standard with manufacturer to meet scheduled fire rating.
    c. Rating: As scheduled.

B. Provide astragals extending full door height on active leaf of pairs of exterior service doors.

C. The top and bottom of out-swinging exterior doors shall be closed with either a flush or inverted channel cap, welded, filled, and finished smooth to provide protection from entry of water inside door.

D. Glass: As shown and specified in Section 08 80 00, "Glazing."

2.07 FINISH HARDWARE PREPARATION

A. Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with Finish Hardware Schedule and templates provided by hardware suppliers. Preparation includes sinkages and cut-outs for mortise and concealed hardware.

B. Provide minimum gage hardware reinforcing in accordance with Table IV of ANSI A250.8 and the following additional requirements.
1. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only in accord with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closers, etc.) is to be applied, doors shall have reinforcing plates.
2. Minimum gages for hardware reinforcing plates shall be as follows:
    a. Hinge and Pivot Reinforcement: 7 gage.
    b. Reinforcement for Lock Face, Flush Bolts, Concealed Holders, Concealed or Surface Mounted Closers: 12 gage.
    c. Reinforcements for All Other Surface Mounted Hardware: 16 gage.

C. Comply with applicable requirements of ANSI/BHMA A156.115.

D. Locate finish hardware as shown on final shop drawings in accordance with locations noted herein.

E. Provide reinforcements for both concealed and surface applied hardware:
1. Drill and tap mortise reinforcements at factory, using templates.
2. Install reinforcements with concealed connections designed to develop full strength of reinforcements.

F. Labeled Doors and Frames: Refer to Section 08 7100, “Door Hardware” for mounting heights of hardware on doors and frames, unless otherwise noted.

PART 3 - EXECUTION

3.01 INSTALLATION OF FRAMES

A. Install frames in accordance with ANSI/SDI A250.11.

B. Secure anchorages and connections to adjacent construction.
   1. Provide not less than three anchors and one floor clip per side for doors up to 7 feet high and four anchors and one floor clip per side for doors over 7 feet high.
   2. Frames over 36 inches wide shall have one anchor at head.
   3. Anchors shall be furnished to suit wall conditions and floor angles or clips welded to frame for fastening to floor.

C. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached. Do not use shipping bars as spreaders.

D. Install fire-rated frames in accordance with NFPA Standard No. 80.

E. Frames at sound-rated doors shall be filled with mineral wool insulation conforming to the requirements of Section 09 82 00, "Acoustic Insulation and Sealants."

3.02 INSTALLATION OF DOORS

A. Install steel doors in accordance with manufacturer's instructions and Project requirements.

B. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

C. Do not erect members that are observed to be warped, bowed, deformed, or otherwise damaged or defaced to such extent as to impair strength or appearance. Remove and replace members that have been damaged in process of erection.

D. Apply hardware in accordance with requirements specified in Section 08 71 00 "Door Hardware."

E. Adjust operable parts for correct function.

3.03 ADJUST AND CLEAN

A. After erection, items with damaged prime coat shall be sanded smooth and touched up with same primer as applied at shop. Touch-up shall not be obvious after application of finish coats.

B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel items undamaged and in complete and proper operating condition.

C. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware or work of other trades, shall be removed and replaced with new at no additional cost to District.

3.04 PROTECTION

A. Protect installed work against damage from other construction work and until ready to receive final finish painting as specified in Section 09 90 00, “Painting and Coating."

END OF SECTION

SECTION 081400
WOOD DOORS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes
   1. Wood flush doors

B. Related Requirements:
   1. Hollow Metal Doors and Frames: Section 08 11 13.
   2. Door Hardware: Section 08 71 00.
   3. Glazing: Section 08 80 00; glass and glazing.
   4. Painting and Coating: Section 09 90 00; site finishing of doors.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D3110: "Standard Specification for Adhesives Used in Nonstructural Glued Lumber Products."
   2. E90: "Measurement of Airborne Sound Transmission Loss of Building Partitions."
   3. E413: "Classification for Determination of Sound Transmission Class."

B. Woodwork Institute (WI): “North American Architectural Woodwork Standards” (NAAWS) published jointly by WI and the Architectural Woodwork Manufacturers of Canada (AWMAC).
   1. Section 5 – Finishing.
   2. Section 9 - Doors.

C. National Fire Protection Association (NFPA):
   1. Standard No. 80: "Fire Doors and Windows."
   2. Standard 252: "National Fire Protection Association Standard Method of Fire Tests for Door Assemblies."

D. Window and Door Manufacturers Association (WDMA), American National Standards Institute (ANSI):
   1. ANSI/WDMA IS-1A-04: "Architectural Wood Flush Doors."
   2. WDMA I.S. 6A-08: “Industry Standard for Architectural Stile and Rails Doors.”
   3. WDMA-INF01: “How To Store, Handle, Finish, Install and Maintain Wood Doors.”

E. Underwriters Laboratories (UL): 10B, "Underwriters Laboratories Fire Tests of Door Assemblies."

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures,” and Section 01 78 36, “Warranties.”

1.04 ACTION SUBMITTALS

A. Shop Drawings: Submit door schedule indicating the following:
   1. Opening-identifying symbol. Use same identification as Door Schedule on Drawings.
   2. Location and sizes of each door.
   3. Door type and grade.
   4. Elevation of each kind of door.
   5. Swing.
   6. Undercuts.
   7. Louvers.
   8. Glazing.
   9. Location and extent of any required hardware blocking.
   10. Special beveling.

B. Product Data: Manufacturer's specifications for each type of wood door proposed for use on this Project. Indicate door core and edge materials and construction; veneer species, type, and characteristics; trim for openings and louvers; and factory finishing and machining criteria.

C. Samples:
   1. Samples of specified door facing, 12 inches square minimum, illustrating .
   2. Samples of door construction, 12 inches square minimum.

D. Sustainable Design: Sustainable Design:
   1. General:
      a. Submit information necessary to establish and document compliance with the California Green Building Code.
      b. Sustainable design submittals are in addition to other submittals.
      c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with the California Green Building Code requirements.

   a.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Special warranty.

1.07 QUALITY ASSURANCE

A. Source Limitations: Obtain wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, doors shall be manufactured in accordance with Section 9 of the "North American Architectural Woodwork Standards (NAAWS)" published jointly by WI and AWMAC.

C. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

D. Allowable Tolerances for Fabrication of Doors: In accordance with referenced NAAWS standard.

E. Fire-Rated Assemblies: Wherever a fire-resistance classification is indicated, provide fire-rated doors investigated and tested as part of a fire door assembly, complete with type of fire door hardware to be used.
   1. Identify each fire-rated door with a label from Underwriters Laboratories, Inc. (UL) or Intertek Testing Services-Warnock Hersey (ITS-WH) indicating applicable fire rating and other specified requirements. Labels shall be attached to door.

F. Sustainable Design Requirements:
   1. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
   2. Regional Materials: Wood doors shall be manufactured within 500 miles of Project.
   3. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
   4. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors at factory prior to shipping, using manufacturer’s standard method.

C. Seal all four edges of site-finished doors after delivery if stored for more than 1 week at the Project site.

D. Label and identify doors for each opening to facilitate proper location using temporary, removable, or concealed markings. Correlate door identification with designation system used on shop drawings.

E. Store doors flat on level surface in clean, dry, and properly ventilated spaces.
   1. Do not expose doors to abnormal heat, dryness, and humidity.
   2. Do not store in areas where sunlight might bleach veneer.

F. Comply with additional requirements specified in Section 01 60 00, "Product Requirements."

1.09 WARRANTY

A. Door Manufacturer's Warranty:
   1. Submit written agreement on door manufacturer's standard form signed by manufacturer, installer, and Contractor, agreeing to repair or replace defective doors which warp (bow, cup, or twist), which show telegraphing of core construction in face veneers, or which do not conform to tolerance limitations of specified quality standards.
   2. Include reinstallation if required owing to repair or replacement of defective doors where defect was not apparent prior to hanging.

B. Warranty Period:
   1. Interior Hollow-Core Doors: 1 year.
   2. Interior Solid-Core Doors: Lifetime of the original installation [5 year, minimum].

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers for Five-Ply Flush Doors:
   1. Marshfield DoorSystems, Inc.
   2. Eggers Industries.
   3. V-T Industries.

2.02 MATERIALS

A. Face Veneer at Flush Doors (To be finalized by architect):
   1. Wood Veneer at Doors to Receive Transparent Finish:
      a. Species: Birch

2.04 FINISHING

A. General: Comply with “Custom” Grade requirements of Section 5 of the NAAWS.

B. Preparation Requirements:
   1. Seal the top and bottom edges of all doors and around all cutouts with two coats of varnish or sealer before the hardware is set into place.
   2. All four edges of doors, door faces, and factory-made cutouts shall be primed or sealed before factory-installed hardware is set into place.
   3. Doors to Receive Transparent Finish:
      a. Before finishing, remove handling marks or effects of exposure to moisture with a complete, thorough, final block sanding over all surfaces of the door, using at least 150-grit sandpaper, and clean before applying sealer or finish.
      b. Deep scratches shall be steamed out before sanding and door replaced if damage is visible.
      c. Sharp edges shall be eased by sanding.
      d. Manufacturer’s standard preparation procedures, if equal to or more stringent, are acceptable.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that doorframes are of type required for door and are installed as required for proper installation of doors.

B. Do not install doors in frames which would hinder door operation.

C. Condition doors to average prevailing humidity in installation area prior to hanging.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and requirements of NAAWS Standards.

B. Door Bevel:
   1. Nonrated Doors: Bevel 1/8 inch in 2 inches.

2. Rated Doors: Bevel as permitted by labeling agency.

C. Install fire-rated doors in fire-rated frames in accordance with requirements of National Fire Protection Association (NFPA) Standard No. 80.

D. Hardware: For installation see Section 08 7100, "Door Hardware."

E. Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

3.03 ADJUST AND CLEAN

A. Replace or rehang doors which are hinge bound and do not swing or operate freely.

B. Protect installed wood doors from damage or deterioration until acceptance of work.

C. Refinish or replace finished doors damaged during installation as directed by the Architect.

END OF SECTION

SECTION 083100
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Access door and frame units, fire-rated and non-fire-rated, for access to interior mechanical closets.

B. Access panels, fire-rated and non-fir-rated, in wall and ceiling locations wherever required for access to enclosed spaces or equipment.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 – Door Hardware: Keying to match District's master key.

B. Section 09 9000 - Painting: Field applied finish.

C. Division 23 - Mechanical: Mechanical and plumbing components requiring access.

D. Division 26 - Electrical: Electrical components requiring access.

1.03 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, Part 2, California Building Code (CBC), International Building Code.

B. ITS (DIR) - Directory of Listed Products.

C. Manufacturer's recommendations and specifications.

D. UL (FRD) - Fire Resistance Directory.

1.04 DESIGN REQUIREMENTS

A. Design Requirements: Provide door seals for access doors located in sound isolating walls or ceilings.

B. Performance Requirements: Provide door covered access into all attic spaces and at all portions of the work to which access is necessary for periodic inspection, adjustments, or maintenance, and which is enclosed behind finish materials, including, but not limited to, valves, water hammer arrestors, mechanical units, electrical panels and outlets, equipment and systems.

1.05 SUBMITTALS

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

B. Schedule: Tabular listing of access doors and panels, indicating location, size, materials, and fire rating.

C. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

D. Shop Drawings: Indicate exact position of all access door units.

E. Manufacturer's Installation Instructions: Indicate installation requirements for fire

rated units.

1.06 REGULATORY REQUIREMENTS

A. Conform to Title 24, Part 2, California Building Code for fire rated access doors.
   1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.

B. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.

1.07 PROJECT CONDITIONS

A. Coordinate the work with other work requiring access doors.

PART 2 - PRODUCTS

2.01 ACCESS DOOR AND PANEL MANUFACTURER

A. Manufacturer: Basis of Design
   1. Acudor Access Panels: www.acudoraccesspanels.com.
   2. Substitutions: See Section 01 2513 – Product Options and Substitutions

2.02 ACCESS PANEL APPLICATIONS

A. Walls, Unless Otherwise Indicated:
   1. Material: Steel.
   2. Standard duty, hinged door.
   3. Interior Locations: Tool-operated spring or cam lock; no handle.
   4. Exterior Locations: Key operated lock; no handle.
   5. In all wall types: Surface mounted face frame and door surface flush with frame surface.

B. Walls in Wet Areas, including Restrooms:
   1. Material: Stainless steel, Type 304.
   2. Standard duty, hinged door.
   3. Key operated lock; no handle.
   4. In all wall types: Surface mounted face frame and door surface flush with frame surface.

C. Fire Rated Walls: See drawings for wall fire ratings.
   1. Material: Steel.
   2. Insulated, double skin door panel.
   3. Exterior Locations: Key operated lock; no handle.
   4. Interior Locations: Tool-operated spring or cam lock; no handle.

D. Ceilings, Unless Otherwise Indicated: Same type as for walls.
   1. Material: Steel.
   2. Size in Lay-in Grid Ceilings: To match grid module.
   3. Standard duty, hinged door.
   4. Exterior Locations: Key operated lock; no handle.
   5. Interior Locations: Tool-operated spring or cam lock; no handle.

E. Fire Rated Ceilings: See drawings for ceiling fire ratings.
   1. Material: Steel.
   2. Standard duty, hinged door.
   3. Interior Locations: Tool-operated spring or cam lock; no handle.

2.03 ACCESS DOOR APPLICATIONS AT INTERIOR MECHANICAL CLOSETS

B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
   1. Model: FW-5050, Fire-Rated Insulated doors as manufactured by Acudor.
   2. Size: As shown on the drawings.
   3. Frames: Steel, 16 gauge, with 1-inch. mounting flange.
   4. Door: Steel, 20 gauge, filled with 2-inch thick fire rated insulation.
   5. Hinges: Concealed, self-closing.
   6. Rating: UL rated for 1-1/2 hours, “B” Label.
   7. Finish: Prime coated for field painting.
   8. Latch: Doors to include mortise cylinder lock, keyed to District’s master key.

2.04 SOURCE QUALITY CONTROL

A. Certifications: Furnish each fire rated door with affixed label of Underwriters Laboratories (UL), Warnock Hersey International (WHI), or other approved independent testing laboratory and inspection service, certifying scheduled fire rating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Investigate conditions requiring access, select panels of suitable type and configuration for conditions indicated.

B. For conditions requiring access and for which panels or doors are not otherwise shown, recommend panel or door type and size for Architect's review.

C. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access. Avoid conflict with other building elements.

END OF SECTION

SECTION 083300
OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rolling service doors.

1.2 RELATED SECTIONS

A. Section 08710 - Door Hardware: Product Requirements for cylinder core and keys.

B. Section 09900 - Painting: Field applied finish.

1.3 REFERENCES

A. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.

B. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.

C. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.

D. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

E. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

G. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

H. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

J. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.3 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.4 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.5 WARRANTY

A. Warranty: Manufacturer’s limited door system warranty for 2 years for all parts and components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corporation, Or Equal

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 ROLLING SERVICE DOORS

A. Light Commercial Doors: Overhead Door Corporation, Model 600 Coil-Away Rolling Service Doors or Equal.
   1. Curtain: Interlocking roll-formed galvanized steel slats, flat crown profile type CAW, 26 gauge for widths up to 12 feet 4 inches (3.75 m), 24 gauge for widths up to 16 feet (4.88 m). End of each slat shall be locked from lateral movement by a staking lock system. (Galvanized alternate malleable end locks.)
   2. Finish:
      a. Curtain slats and hood shall be galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
         1) Polyester Top Coat.
            (a) White polyester.
         2) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
   3. Weatherseals: Vinyl bottom seal.
   4. Bottom Bar: Extruded aluminum.
   5. Guides: Roll-formed galvanized steel shapes attached to continuous galvanized steel wall angle.
      a. Finish: PowderGuard Premium powder coat, color as selected by Architect.
   6. Brackets: Galvanized steel to support counterbalance and curtain.
      a. Finish: PowderGuard Premium powder coat, color as selected by Architect.
   7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel and supporting the curtain with deflection limited to 0.03 inch per foot of span. Spring tension shall be adjustable.
   8. Hood: 24 gauge galvanized steel with intermediate supports as required.

9. Manual Operation:
   a. Chain hoist for doors over 100 SF.
10. Wind load Design:
   a. FBC certification FL#_____.
11. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
12. Locking:
   a. Two interior bottom bar slide bolts for manually operated doors.
   b. Chain keeper locks for chain hoist operation.
   c. Interior slide bolt lock for electric operation.
13. Wall Mounting Condition: Face-of-wall.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07920.

F. Install perimeter trim and closures.

G. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 084113
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed thermally broken storefront assemblies
2. Aluminum-framed glass entrance doors
3. Site tests and inspections
4. Supplementary components and accessories normally furnished or necessary for a complete installation, whether or not such items are indicated on the Drawings or included in the Specifications

B. Related Requirements:

1. Section 08 71 00 for door hardware
2. Section 08 80 00 for glass glazing
3. Section 08 51 13 for windows

1.2 REFERENCES

A. Abbreviations and Acronyms:

1. AAMA: American Architectural Manufacturers Association
2. WDMA: Window & Door Manufacturers Association
3. CSA: Canadian Standards Association
4. ASTM: American Society for Testing and Materials
5. AA: Aluminum Association
6. NFRC: National Fenestration Rating Council

B. Definitions:

1. Manufacturer: Means the entrance door or storefront manufacturer, as the context admits, unless otherwise indicated
2. Failure: Includes noise or vibration caused by movement, material deterioration beyond normal weathering, water leakage through fixed glazing and framing areas, and failure of operating components
3. Water Leakage: Means no uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than

condensation. Water leakage does not include water controlled by flashing and gutters that is drained to the exterior

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate building opening tolerances with entrance door manufacturing and erection tolerances
2. Coordinate hardware preparations, handing, and reinforcement requirements and locations with the Drawings, door schedule, and selected hardware sets
3. Coordinate entrance door hardware finishes with other door hardware finishes
4. Coordinate building opening tolerances with storefront manufacturing and erection tolerances. The manufacturer must accommodate building frame tolerances

B. Performance Requirements:

1. General: Entrances and storefronts must establish and maintain a continuous watertight seal without failure
2. Basis of Design and DSA Approved: Arcadia AFG601T (2” x 6”) and AFG451T (2" x 4-1/2") Series thermally broken offset glazed system with screw spline, shear block, compensating stick or punched opening fabrication for 1" glass
3. Design Pressure: Calculate in conformance with American Society of Civil Engineers/Structural Engineering Institute publication ASCE/SEI 7, "Minimum Design Loads and Associated Criteria for Buildings and other Structures"
4. Superstructure Deflection and Story Drift: Accommodate design displacement of adjacent stories indicated on the structural drawings
5. Seismic Loads: Resist, distribute, or transfer seismic loads indicated on the structural drawings without incipient or catastrophic failure. System shall conform to AAMA recommended static test method for evaluating performance due to horizontal displacements associated with seismic movements and building sway
6. Perpendicular Deflection (Convexity and Concavity): a. Storefront Framing Spans up to 13 Feet 6 Inches: Framing members may not deflect more than L/175 or 3/4-inch, whichever is less, measured normal to the assembly plane b. Storefront Framing Spans between 13 Feet 6 Inches and 40 Feet: Framing members may not deflect more than L/240 plus 1/4-inch, measured normal to the assembly plane c. Deflection of the horizontal sill member due to the weight of the glass should not exceed 1/8-inch nor should the deflection decrease the head clearance of the panel below by more than 25 percent d. Storefront Spans Greater than 40 Feet: Provide structural analysis e. Cantilever Deflection: Not more than 2L/175, where "L" is the cantilever length, measured normal to the assembly plane f. Center of Glass Deflection: Not more than

L/50 of short side length, or one inch, whichever is less, measured normal to the assembly plane

7. Parallel Deflection (Sagging): Limit deflection under maximum design load to either 1/8-inch or not more than 25-percent reduction in glass bite, whichever is smaller measured in line with the assembly plane a. Minimum Clearance Between Framing Members and Top of Glazing or other Fixed Component Immediately Below: 1/8-inch b. Minimum Clearance Between Framing Members and Operable Components, Including Doors and Entrances: 1/16-inch c. Maximum Twisting of Doors and Entrances: Twisting (rotation) of horizontal framing members caused by glass weight may not exceed one degree, measured between the ends and the center of each span

8. Permanent Deformation: No permanent deformation at design pressure. Limit permanent deformation to 0.2 percent of the clear span of any framing member, when tested in conformance with ASTM E 330 (uniform static pressure test) a. Maximum Positive and Negative Test Loads: Equal to at least the specified design pressure b. Maximum Positive and Negative Proof Loads for Vertical Glazing: At least equal to 1.5 times the design pressure c. Maximum Positive and Negative Proof Loads for Sloped Glazed Assemblies: At least equal to 2.0 times the design pressure d. Duration of Maximum Test and Proof Loads: 10 seconds e. Measurement: The number and location of deflection measurements must be shown on the mockup shop drawings prior to testing. At a minimum, indicate measurement of deflection at maximum deflection and end deflection locations

9. Thermal Transmittance (U-Factor): Maximum assembly thermal transmittance value may not exceed the following a. Maximum Winter Nighttime Transmittance (U-value): Not more than 0.41 for fixed assemblies; and 0.46 BTU per hour per square foot per deg. F. for operable assemblies b. Maximum Summer Daytime Transmittance (U-value): Not more than 0.42 BTU per hour per square foot per deg. F. c. Thermal Performance to be validated when tested in accordance with AAMA 1503.1 and NFRC 100

10. Air Leakage (AL): Maximum permanent AL rating of not more than 0.06 cubic feet per minute per square foot, when tested in conformance with ASTM E 283 at 6.24 pounds per square foot minimum differential static air pressure

11. Water Leakage: No water leakage through the assembly or joints, when tested in conformance with both ASTM E 331 (uniform static air pressure test) and AAMA 501 (dynamic pressure test) at 8 pounds per square foot minimum differential pressure

12. Condensation Resistance Factor (CRF): Minimum CRF value of at least the following, when tested in conformance with NFRC 500 a. Combined Framing Members and Glazing: At least 56 b. Framing Members Only: At least 70

13. Sound Transmission Class (STC): Provide complete assemblies (both frame and glazing) having a minimum laboratory-tested STC value of at least that indicated on the Drawings for glass and frame together, as determined in conformance with ASTM E 413, based on testing in conformance with ASTM E 90

14. Outdoor-Indoor Transmission Class (OITC): Provide complete assemblies (both frame and glazing) having a minimum laboratory-tested OITC value of at least that indicated on the Drawings for glass and frame together, as determined in conformance with ASTM E 413, based on testing in conformance with ASTM E 90

15. Thermal Expansion and Contraction: Accommodate expansion and contraction movement resulting from at least 120 deg. F ambient and 180 deg. F material surface temperature differentials (changes)

16. Dissimilar Metal Corrosion Protection: Permanently isolate metal surfaces from direct contact with incompatible materials and other potentially corrosive substrates as specified in Section 05 50 00

C. Preinstallation Meeting:

1. Hold a meeting after submittal approval and at least 10 business days before beginning installation

2. During the meeting, review the Contract Documents, submittals, project conditions, and installation sequence and methods, including special details and conditions that might affect installation

3. Identify and discuss adverse or unfavorable conditions detrimental to protecting stored materials or to installation; or to the quality, durability, appearance, or performance of installed entrances and storefronts. Resolve each condition

4. Identify and discuss site tests and inspections, including test procedures, methods, differential pressures, sequencing, measurement, results, acceptance criteria, remedial work, recording and distributing results, and other topics necessary to carrying out required site tests and inspections

5. Identify and discuss equipment, tools, facilities, personnel, and controls necessary for each site test and inspection

6. Finalize construction schedule

7. Record significant discussions and distribute meeting minutes. Do not begin installation until disagreements are successfully resolved to the satisfaction of all parties

1.4 SUBMITTALS

A. Action Submittals: Submit the following for responsive action (formal review and approval)

1. Product Data: a. Submit manufacturer's product data, specifications, typical installation details, and all other information necessary to show conformance to the Contract Documents, excluding material safety data sheets (MSDSs) and safety data sheets (SDSs), both of which are returned to the Contractor without review or responsive action b. Submit sample warranties with warranty periods, terms, conditions, exclusions, and remedies explicitly defined for each warranty, including clear warranty period start dates c. Include Arcadia AFG451T Series product data demonstrating compliance with

specified performance requirements d. Include test reports from AAMA accredited laboratories certifying the performances as specified

2. Door Schedule: Submit schedule showing opening identification symbols and entrance door types and sizes, including thickness, swing, fire-resistance rating label requirements, and undercuts. Use the same reference numbers for openings and details as the Drawings

3. Shop Drawings: a. Submit dimensioned plans and elevations drawn to scale and showing entrance door and storefront layout, materials, construction, and finishes. Show locations, sizes, and extents of all items, accessories, and trim. Label manufactured items by product name b. Include project-specific dimensioned details drawn to scale showing conditions not detailed on the product data; or that are detailed, but not in a manner specific to the project. Cross-reference entrance door details to door schedule. Cross-reference storefront details to plans and elevations c. Show continuous sub-sill detail under sill members to collect water infiltration and divert from the interior of the system

4. Samples: a. Submit at least 6-inch square representative samples of each entrance door and storefront framing color and finish

B. Informational Submittals: Submit the following for information (informal review: responsive action not expected or required, except to record non-conformance with submittal requirements)

1. Manufacturer's Instructions: Submit manufacturer-prepared published instructions for proper installation of furnished entrance doors and storefronts a. If manufacturer's instructions are unavailable or do not apply to specific project conditions, then consult the manufacturer's representative and obtain project-specific supplemental instructions printed on manufacturer's letterhead b. Promptly distribute supplemental instructions to the Architect, who may have comments that lead to contract modifications or minor changes in the work

2. Qualification Statements: Submit written descriptions confirming experience specified in QUALITY ASSURANCE article below

C. Closeout Submittals: Submit the following to the Architect as a condition of project closeout

1. Maintenance Data: Submit copies of manufacturer's instructions and other requirements and recommendations for entrance door maintenance, cleaning, and repair

2. Warranty Documentation: Submit final warranties signed by the manufacturer's representative with complete terms indicated for all warranties covering items furnished or installed under this specification section

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Entrance doors and storefronts must be obtained through one source from the same manufacturer (to ensure compatibility, regulatory conformance, and a warrantable installation) a. Certain items may be obtained from more than one manufacturer, but only when used for separate installations b. Items provided for each different installation must be obtained from the same source and manufacturer
2. Provide secondary materials, components, accessories and other items from sources required, recommended, or accepted by the primary manufacturer for actual in-service conditions applicable to the project

B. Regulatory Requirements:

1. Automatic and power-assisted doors must conform to the requirements of California Building Code Section 11B-404.3
2. Comply with applicable provisions of AAMA Aluminum Storefront and Entrance Manual for design, materials, fabrication and installation of component parts

C. Quality Standard Requirements:

1. Entrance Door Product Standard: Comply with the requirements of ANSI/AAMA/WDMA publication ANSI/AAMA/WDMA 101/I.S.2/NAFS-02, "Windows, Skylights and Glass Doors"
2. Entrance Door Performance Standard: Comply with the requirements of AAMA/WDMA/CSA publication AAMA/WDMA/CSA 101/I.S.2/A440, "NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights"
3. National Fenestration Rating Council (NFRC) specific application evaluation required

D. Qualifications:

1. Manufacturer: Company or individuals must have at least 10 years' experience manufacturing entrance doors and storefronts installed on at least 200 previous projects similar to this project in size, material, design, and complexity
2. Installer: Company or individuals must have at least 5 years' experience installing entrance doors and storefronts for at least 30 previous projects similar to this project in size, material, design, and complexity
3. Supervisors: Individuals must have at least 7 years' experience installing entrance doors and storefronts for at least 30 previous projects similar to this project in size, material, design, and complexity, including at least 2 years' supervisory experience directing and leading entrance and storefront installers
4. Engineer: Must be a licensed professional structural engineer registered to practice in California having at least 10 years' experience performing the kind of engineering services indicated for at least 20 previous projects similar to this project in size, material, design, and complexity

E. Mockups: If an ex-situ exterior wall integrated mockup is required for this project, then integrate entrance doors and storefronts into the mockup as part of the work of this specification section

1.6 HANDLING

A. Receiving: Inspect all deliveries for deteriorated, damaged, and defective items

1. Reject items that are not packaged in a manner that prevents damage; or that exhibit deterioration or damage or have damaged or open packaging or containers
2. Unload and store only inspected and accepted items

B. Storage: Store unloaded items as shipped and in conformance with manufacturer's instructions and other requirements and recommendations for storage. Furnish adequate dunnage and bracing during storage

1. Prevent stored items from contacting the floor or ground, from soiling and staining, and from deterioration and damage
2. If items are not stored in an enclosed location, then cover the tops and sides with securely-tied, waterproof, and breathable covers. Unvented polyethylene tarpaulins do not qualify as breathable covers and are prohibited
3. Incline covered items to ensure maximum drainage of accumulated moisture
4. Do not leave items uncovered where they might be exposed to weather or become wet; or exposed to other sources of deterioration and damage

C. Handling: Handle items in conformance with manufacturer's instructions and other requirements and recommendations, and in a manner that prevents damage

D. Damaged Item Replacement: Promptly remove and replace deteriorated, damaged, or defective entrances or storefront materials with undamaged new items or materials that do not exhibit deterioration, damage, or defects

E. Packaging Waste Management: Do not burn or bury construction waste at the project site. Remove and legally dispose of all construction waste away from the project site

1.7 WARRANTY

A. Manufacturer Warranty: Furnish to the Owner a written manufacturer warranty for products, components, and accessories against all patent and latent defects, and incipient and catastrophic failure for 5 years; and for finishes against color fading, chalking, cracking, checking, peeling, and adhesive failure for 20 years

B. Installer Guarantee: Furnish to the Owner a written guarantee for the work of this specification section against all defects in materials and workmanship for 2 years from date of acceptance. Guarantees must be properly prepared and signed on the guarantee form in Division 01

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design and Permit Approval: See below under description of products.

1. Arcadia, Inc.; Product Storefront AFG451T: www.arcadiainc.com.
2. Arcadia, Inc.; Product Window Wall AFG601T: www.arcadiainc.com
3. Arcadia, Inc.; Product Doors WS512HD: www.arcadiainc.com

B. Other Acceptable Manufacturers (Substitutions):
   1. Substitutions: See Section 01 60 00-Product Requirements.
      a. Substitution may or may not be accepted after Architect and Owner review with complete evaluation for content and schedule impact.
      b. Substitutions shall include all costs for redesign with consequential changes by other Contractor trades along with the Architect and related approvals by governing agencies.
         1) Revisions to shop drawings illustrating the proposed changes is not considered adequate for DSA review and approval.
         2) A minimum fee of $15,000.00 for DSA review processing by the Architect will need to be included for DSA review of any substituted system other than the basis of design.
         3) An additional minimum allowance of $15,000.00 is required for Architects time to review the substituted system prior to submitting for governing agency approval.
         4) The indicated fee amounts are minimums. These are subject to increase pending Architect and Agency reviews of the proposed substitution.
      c. Substitutions may be acceptable, based on Architect's review and approval, for submittal to DSA. If substituted manufacturer cannot reproduce DSA design and approval in a timely manner, then they shall be subject to a time and material back charge for any delays in the project. Architect approval is required prior to DSA submittal and DSA approval is required prior to installation.

2.2 ALUMINUM-FRAMED STOREFRONTS

A. Description: Thermally broken storefront framing system providing flush glazing on all sides without projected stops, with glass forward or inward of the frame. Framing system suitable for outside or inside glazing

B. Basis of Design Product: "AFG451T Series" manufactured by Arcadia, Inc.

1. 2" x 4-1/2" thermally broken offset glazed system
2. Screw spline, shear block construction
3. Compensating stick or punched opening fabrication
4. For 1" glass

C. Basis of Design Product: "AFG601T Series" manufactured by Arcadia, Inc.

1. 2" x 6" thermally broken offset glazed system
2. Screw spline, shear block construction
3. Compensating stick or punched opening fabrication
4. For 1" glass

D. Requisite Properties:

1. Framing Size: 2 inches by 4-1/2 inches and 2 inches by 6 inches
2. Glazing Thickness: One-inch
3. Glazing Installation: Outside glazed
4. Exposed Finishes: Specified in Section 05 50 00
5. Concealed Steel Finishes: Prepare surfaces and apply shop primer
6. Concealed Aluminum Finishes: Prepare surfaces and coat aluminum surfaces in contact with masonry, concrete, or steel with bituminous paint specified in Section 05 50 00
7. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system
8. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements, for hardware attachment, and as indicated
9. Fasteners shall be so located as to ensure concealment from view in the final assembly

2.3 ALUMINUM-FRAMED ENTRANCES

A. Description: Heavy Duty wide stile entrance doors

B. Basis of Design Product: "WS512HD Series" manufactured by Arcadia, Inc.

D. Requisite Properties:

1. Entrance Door Thickness: 1-3/4 inches
2. Vertical Stile Width: 5 inches
3. Top Rail Width: 5 inches
4. Bottom Rail Width: 10 inches
5. Glazing Thickness: One-inch
6. Glazing Stops: Square, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door
7. Exposed Finishes: Specified in Section 05 05 14

2.4 MATERIALS

A. Aluminum:

1. Standard Aluminum Structural Profiles: ASTM B 308, Alloy 6061-T6
2. Extruded Aluminum Bars and Shapes: ASTM B 221, Alloy 6063-T5 or T6 for primary components; Alloy 6063-T5 or T6, 6005-T5, 6105-T5 or 6061-T6 for structural components
3. Aluminum Sheet and Plate: ASTM B 209, Alloy 5005-H32 or Alloy 3003-H14
4. Extruded Aluminum Tubes: ASTM B 221 or ASTM B 483
5. Structural Aluminum Pipe and Round Tube: ASTM B 429
6. Arcadia standard framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6)

B. Glazing: Specified in Section 08 81 00

2.5 ACCESSORIES

A. Steel Reinforcement: When required by engineering calculations, provide steel bent plate or shapes conforming to ASTM A 36 and shop primed

B. Brackets: Provide high-strength aluminum or austenitic stainless steel brackets and reinforcements

C. Sill Flashing: Fabricate from at least 0.060-inch thick aluminum sheet, with welded end dams and finished to match frames

D. Concealed Flashing: Stainless steel sheet conforming to ASTM A 240 (annealed) Type 304 (for all other applications), No. 2D (matte) finish, annealed, No. 4 (soft) temper (hardness not more than Rockwell B-65; can be bent flat upon itself in any direction)

E. Movement Joints: Slip-joint linings, slip pads, spacers, and sleeves of material and type supplied, required, recommended, approved, or accepted by the manufacturer

F. Glazing Gaskets:

1. Manufacturer's standard compression-type design, replaceable, molded or extruded ethylene propylene diene monomer (EPDM) conforming to ASTM C 864 and having a Shore A hardness value of at least 70, unless another type of gasket is supplied, required, recommended, or accepted by the manufacturer
2. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging

G. Silicone Gutter Gaskets: Custom extrusions installed with low modulus single-component sealant specified in Section 07 92 00

H. Fastenings: Provide backings, inserts, loose connection hardware, fasteners, anchors, attachments, connectors, and other items supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices
2. Reinforce framing members as required to receive fastener threads
3. Exposed fasteners are prohibited on faces exposed to view. Provide concealed fasteners and expansion provisions
4. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum

I. Anchors:

1. Anchor Bolts (Anchor Rods): Cast-in-place anchors having minimum 60 ksi tensile strength
2. Other Anchors: a. Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by the manufacturer b. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements

J. Cleaning Agent and Cloth: Supplied, required, recommended, or accepted by the structural sealant manufacturer

K. Other Accessories: Provide accessories and secondary items normally furnished or necessary for a complete installation; or supplied, required, recommended, or accepted by the manufacturer for actual in-service conditions applicable to the project

2.6 FINISHES

A. Finish all exposed areas of aluminum and components as indicated

B. Anodized Finishes:

1. An Architectural Class II or I anodic coating conforming with AA-M12C22A31/AA-M12C22A41 a. Anodize finish color shall be Colornodic _____ (#11 Clear)

C. Fluorocarbon Coating: AAMA 2605

1. Resin: 70% PVDF Kynar 500/Hylar 5000
2. Substrate: cleaned and pretreated with chromium phosphate
3. Primer: Manufacturer's standard resin base compatible coating. Dry film thickness a. Extrusion: Minimum 0.20 mil

4. Color Coat: 70% PVDF, dry film thickness a. Extrusion: 1.0 mil
5. Color: As selected by Architect
6. Acceptable Coatings Manufacturers: a. PPG Industries, Inc. b. Sherwin Williams

PART 3 - EXECUTION

3.1 EXAMINATION

A. Oversight: Ensure an adequate number of supervisors are present and proper supervision practices are followed at the project site before the installer begins work and at all times during installation

B. Verification: Verify in-place supporting and adjacent construction conforms to the manufacturer's requirements or recommendations and satisfies all other conditions that might affect the quality of installation or the durability, appearance, or performance of installed and adjacent items

C. Evaluation and Assessment:

1. Identify project conditions that do not conform to the manufacturer's instructions and other requirements and recommendations
2. Perform or arrange and pay costs without reimbursement from Owner for all remedial work necessary to correct or improve deficient conditions, without limitation, before the installer begins work
3. Examine conditions and verify substrate conditions are acceptable for product installation

3.2 INSTALLATION

A. General Requirements:

1. Install entrance doors and storefronts using materials and methods required, recommended, or accepted by the manufacturer, along with manufacturer-recommended accessories and techniques
2. Install in accordance with approved shop drawings and manufacturer's installation instructions
3. Set items true to line, to required levels and lines, and plumb, level, and square, without warp or rack, with flush well-fitted joints, and in alignment with adjacent construction
4. Perform drilling and fitting as required or necessary for an accurate fit and complete installation
5. Installed entrance doors and storefronts must be warrantable. Do not install, correct, or replace entrance doors and storefronts in a manner that results in any warranty or guarantee becoming void

B. Special Techniques:

1. Use concealed fasteners and anchorages. Provide washer head fasteners with bonded sealing washers where required to protect metal surfaces and to make weathertight connections
2. Form closely-fitted joints with exposed connections accurately located and secured
3. Provide uniform-width perimeter reveals and opening sealants and joint fillers as indicated
4. Install concealed gaskets, flashings, and joint fillers as the storefront installation progresses

C. Interface with Adjacent Items: Provide materials, components, and accessories normally furnished or necessary to securely attach entrance doors and storefronts to supporting construction

D. Entrance Door Installation Tolerances: Install entrance doors within the following clearance variations

1. Jambs and Head: 1/8-inch plus or minus 1/16 inch
2. Between Edges of Pairs of Doors: 1/8-inch plus or minus 1/16-inch
3. Between Bottom of Door and Top of Threshold: Maximum 1/4-inch
4. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 1/4-inch

E. Storefront Installation Tolerances: Install storefronts within the following tolerance variations

1. Maximum Variation from True Position: Not more than 1/8-inch in 12 feet nor more than 1/4-inch over any total length
2. Maximum Variation from Plane: Not more than 1/8-inch in 12 feet nor more than 1/2-inch over any total length
3. Maximum Out of Plumb: Not more than 1/8-inch in 10 feet nor more than 1/4-inch in any 40-foot run
4. Maximum Out of Level: Not more than 1/8-inch in 20 feet nor more than 1/4-inch in any 40-foot run
5. Maximum Misalignment of Adjacent Members: 1/16-inch
6. Maximum Offset between Components at Joints: a. In-line Surfaces: Not more than 1/16-inch, except that offset are not allowed at welded joints b. Corners: Not more than 1/32-inch
7. Squareness: Not more than 1/8-inch difference in diagonal measurements
8. Maximum Bow: Not more than 1/16-inch in any four foot framing length

3.3 ADJUSTING

A. Verify smooth and quiet entrance door and hardware operation

B. Lubricate and adjust operating parts and hardware to function properly, free from warp, twist, binding, and distortion. Confirm latches and locks engage securely without forcing or binding

C. Replace items that do not operate freely in a safe and reliable manner

3.4 FIELD QUALITY CONTROL

A. Site Tests and Inspections:

1. General: Include site tests and inspections as part of the work of this specification section. The Owner's testing and inspection agency performs tests and inspections a. Schedule and arrange all tests and inspections b. Coordinate all work and the final construction schedule with all tests and inspections c. Coordinate tests and inspections with the work of other specification sections, and other specified, required, or necessary tests and inspections d. Furnish all work, equipment, tools, facilities, personnel, and controls necessary for each test and inspection e. Arrange tests and inspections by notifying the Owner, the testing and inspection agency, the installer, the manufacturer's representative, and the Architect at least 5 business days before work is ready for testing or inspection f. Witness all site tests and inspections g. Receive test and inspection reports and distribute them to the installer and the manufacturer's representative h. When tests and inspections reveal defective items, repair defective work to the satisfaction of the manufacturer's representative and Architect, and re-test and re-inspect work without reimbursement from Owner until all work passes tests and inspections

2. Required Tests: a. Water Leakage Hose Tests: Perform water leakage hose tests in conformance with AAMA 501.2 (fixed glazing assemblies) and AAMA 502 (operable window units). At least 10 percent of installed aluminum framed entrances and storefront assemblies must be AAMA nozzle tested. Conduct test in the presence of the Architect b. Air and Water Leakage Chamber Tests: Perform air and water leakage chamber tests in conformance with AAMA 502, Test method B. At least 2 testing sites for each assembly spanning 3 periods: Mockup, 10 percent complete, and 50 percent complete

3. Testing Requirements: a. E1105 chamber test is only used for discrete window units having a maximum 8-foot by 8-foot test size. For areas larger than 8-feet by 8-feet, perform nozzle testing in conformance with AAMA 501.2, differential pressure testing b. 2/3 reduction of laboratory air pressure for field testing pressure is permitted c. If sill receptors are used, add in another test to occasionally test sill receptors and other horizontal cavities that may collect water by temporarily plugging weep holes and filling with water in conformance with AAMA 502, at least 15-minute test duration, and at least 3 additional locations. Remove weep hole plugs and drain system at conclusion of test. Perform tests at start of the work and periodically throughout the construction process (minimum once every two weeks of installation) d. For each failure condition discovered, make remedial and corrective action approved by the Owner and Architect, and

complete similar detailing at all similar conditions and locations e. Additional testing and inspecting shall be at Contractor's expense, and will be performed to determine compliance of replaced or additional work with specified requirements. Add one additional test location for each failure

1. If a testing specimen fails air testing, perform smoke tracer testing in ASTM E 1186

3.5 CORRECTION AND REPAIR

A. Non-conforming, damaged, and defective work must be brought into conformance with the Contract Documents. Correct and repair as necessary, without limitation, including arranging all correction and repair work and paying all correction and repair costs, and re-inspection and re-testing costs, without reimbursement from Owner, until accepted in writing by the Architect

B. Corrective and repair work must be performed in conformance with a correction and repair plan submitted to and accepted in writing by the Architect before correction or repair work begins. At a minimum, correction and repair plans must include:

1. Written descriptions of non-conforming, damaged, and defective work
2. Supporting sketches, diagrams, photographs, and other visual depictions of non-conforming, damaged, and defective work
3. Similar written descriptions and visual depictions of Contractor-proposed corrections and repairs

C. Arrange and pay costs without reimbursement from Owner for removing and replacing work that cannot be corrected or repaired to the Architect's acceptance

3.6 CLEANING

A. Waste Management: After completing the work of this specification section, leave work areas free from debris, waste, scrap, equipment, tools, and other items

3.7 PROTECTION

A. Protect installed entrance doors and storefronts in place from soiling, deterioration, and damage until Substantial Completion

B. Do not store anything adjacent to or against installed entrance doors and storefronts unless they are protected from damage, as accepted in writing by the manufacturer's representative. Do not use installed entrance doors and storefronts as work surfaces

C. Remove protection when it's no longer needed and before Substantial Completion

END OF SECTION

SECTION 085113
ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Aluminum windows of the Types shown on the Drawings.
   2. Aluminum windows of the following types:
      a. Fixed windows.
      b. Casement windows.
      c. Sliding windows
   3. Factory glazing.

B. Related Sections:
   1. Sheet Metal Flashing and Trim: Section 07 62 00; sill flashing and end dams.
   2. Joint Sealants: Section 07 92 00; sealant at perimeter of windows.
   3. Glazing: Section 08 80 00

1.02 REFERENCES

A. Aluminum Association (AA):
   1. DAF-45: "Designation System for Aluminum Finishes."

B. American Society for Testing and Materials (ASTM):
   1. A123: "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
   2. A780: "Practice for Repair of Hot-Dip Galvanized Coatings."
   3. B137: "Method for Measurement of Weight of Coating on Anodically Coated Aluminum."
   4. B221: "Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes."
   5. B244: "Method for Measurement of Thickness of Anodic Coatings on Aluminum and of other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments."
   6. C509: "Standard Specification for Cellular Elastomeric Preformed Gasket and Sealing Material."
   7. C864: "Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers."
   8. E283: "Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors."
   9. E330: "Test Methods for Structural Performance of Exterior Windows, Curtain walls, and Doors by Uniform Static Air Pressure Difference."
   10. E331: "Test Method for Water Penetration of Exterior Windows, Curtain walls, and Doors by Uniform Static Air Pressure Difference."

C. American Architectural Manufacturers Association (AAMA):

D. ANSI/AAMA 101: "Standard/Specification for Windows, Doors, and Unit Skylights."

E. AAMA 701/702 "Voluntary Specifications for Pile Weatherstripping and Replaceable Fenestration Weatherseals."
   1. AAMA 800: "Voluntary Specifications and Test Methods for Sealants."
   2. AAMA 2400: "Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction."
   3. AAMA 2603: "Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels."
   4. AAMA 2605: "Voluntary Specification for High Performance Organic Coatings on Aluminum Extrusions and Panels."

F. National Fenestration Rating Council (NFRC).

1.03 SYSTEM DESCRIPTION

A. System: Provide a complete system with joints, gaps, penetrations, and junctures with adjacent surfaces sealed and made watertight.

B. Hardware shall comply with the CBC including provisions for accessibility by the physically handicapped required by the Title 24, Part 2, and the ADA.

C. Design Requirements:
   1. Windows shall meet or exceed the air and water infiltration requirements for H-LC25 Performance Class and Grade of American Architectural Manufacturers Association (AAMA) 101, "Standard/Specification for Windows, Doors, and Unit Skylights."
   2. Windows shall conform to ANSI/AAMA 101 for each window type, grade, and class indicated. ANSI/AAMA 101 Optional Performance Class:
   3. Optional Performance Class shall be increased to 35 for units located 40 or more feet above grade.
   4. Acoustical:

Frequency - Hz	Sound Level – dB
100	88
125	90
160	92
200	92
250	91
315	90
400	89
500	88
630	87
800	86
1,000	85
1,250	83
1,600	82
2,000	79
3,150	76

D. Labels: Apply National Fenestration Rating Council (NFRC) label indicating U-value in conformance with California Energy Commission Section 116 requirements. Testing for thermal resistance ratings shall be by an approved testing laboratory in accordance with the NFRC requirements.

1.04 SUBMITTALS

A. Procedures: In accordance with Section 01 3300, "Submittal Procedures."

B. Shop Drawings: Dimensioned and annotated elevations of all window types and details of installation. Manufacturer's standard details are acceptable if modified to show actual installation conditions required for this Project.
   1. Show dimensions, member profiles, details of interface with other building construction, method and location of attachment to structural system, and glazing materials.
   2. Prepare elevations at scale of 1/2-inch equals 1 foot, and full- or half-size detail sections of each typical member.
   3. Show deviations from Contract Documents. Clearly delineate locations on plan.
   4. Indicate field measurements.

C. Product Data: Manufacturer's literature for windows, glass, each premanufactured component, including installation recommendations, standard details and finishing, hardware, and other components of the work.

D. Samples:
   1. 12-inch-long section of extrusion Corner, with legs 12 inches by 12 inches, complete with glazing] in specified finish.

E. Quality Control:
   1. Laboratory test reports indicating compliance with design criteria.
   2. [Structural Certification by registered structural engineer indicating that system complies with the Contract Documents and applicable codes.
   3. Results of field testing.

F. Closeout: Extended warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle windows and accessories in accordance with AAMA CW-10.

B. Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

C. Comply with additional requirements specified in Section 01 60 00, "Product Requirements."

1.06 FIELD CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

1.07 WARRANTY

A. Procedures: In accordance with Section 01 7836, "Project Warranties."

B. Furnish to Owner manufacturer's written 5-year assembly guarantee for each type of window against all defects in materials and workmanship, including without limitation against water leakage and structural failure.

B. See Section 08 8000, "Glazing," for warranty requirements for sealed insulating glass units.

PART 2 - PRODUCTS

2.01 ALUMINUM WINDOWS

A. DSA approved, Product and Manufacturer: Thermally broken aluminum windows - Model T200 Casement by Aracadia, in accordance with ADA hardware and 4” window limiters

B. DSA approved, Product and Manufacturer Model ULT5920 Sliding Window by Arcadia

2.02 ALUMINUM WINDOW AND MATERIALS AND COMPONENTS

A. Frame and Sash: ASTM B221, extruded aluminum 6063-T5 alloy.

B. Fasteners and Miscellaneous Fastening Devices: Aluminum, stainless steel, or other non-corroding and non-corrosive material compatible with aluminum.

C. Latches and Handles: Aluminum, color to match frame.

D. Weatherstripping: Continuous material, resistant to weathering, around outside of sliding panel. Pile shall conform to AAMA 701.2.

E. Concealed Gaskets: Molded expanded EDPM or neoprene complying with ASTM C509.

F. Glass: Clear, insulating low-E glass as specified in Section 08 80 00, "Glazing," except as otherwise scheduled on Drawings.

G. Overall Thickness: 1/4-inch, unless otherwise standard with manufacturer.

H. Glazing Materials: As specified in Section 08 80 00, "Glazing." (See Glazing Schedule on drwgs.)

I. Dissimilar Metal Coating: Cold-applied asphalt mastic, zinc chromate paint, or other nonconductive, nonabsorptive material.

J. Joint Sealers: As specified in Section 07 92 00, "Joint Sealants."
   1. Use only nonhardening, nonshrinking, and nonmigrating materials.
   2. For nonworking metal-to-metal joints within framing members, use small joint sealant, conforming to 803.3 as described in AAMA 800.
   3. Flashing:
   4. Self-Adhering Flashing: As specified in Section 07 65 00, “Flexible Flashing and Underlayment.” Unless otherwise shown, provide self-adhering flashing around perimeters of all windows.
   5. Sill Flashing: Minimum 22 gage sheet aluminum of sizes and shapes indicated and required to drain water to exterior, finished to match aluminum windows.

K. Auxiliary Locks and Stops:
   1. Except at code required egress windows, provide an auxiliary non-keyed locking device for operable units accessible from grade or other public and common areas.
   2. Provide safety stops where opening is less than 42 inch above finish floor. Device shall be approved by the Architect. A safety chain is not acceptable.

L. Screens: To be finalized by architect.

2.03 FABRICATION

A. Fabricate windows to sizes and configurations shown on accepted shop drawings.
   1. Provide flush Phillips flat-head or Allen screws where exposed.
   2. Indicate exposed fasteners on shop drawings for specific approval.
   3. Provide concealed fasteners for glazing stops.
   4. Finish exposed aluminum fasteners to match aluminum work.
   5. All visible edges shall be smooth and factory painted.
   6. Delete the following paragraphs where not applicable.
   7. Fabricate windows with true divided lights; internal grids are not acceptable.

B. Provide custom frame extensions as indicated on Drawings.

C. Shop-glaze window units with specified insulating glass in accordance with glazing requirements specified in Section 08 80 00, "Glazing."

D. Factory test each type of window with specified glazing to confirm compliance with meeting required STC rating.

2.04 FINISH

A. Aluminum Finish: Exterior and interior surfaces shall receive a high-performance fluoropolymer eecoating containing minimum 70 percent polyvinylidene fluoride (PVDF) resin ("Kynar 500"/"Hylar st¼" 5000") and meeting or exceeding all the requirements of AAMA 2605; PPG Industries "Duranar," or equal.
   1. Color(s): Custom to be selected by Architect.

B. Manufacturer's standard thermosetting acrylic enamel conforming to AAMA Specification 2603.
   1. Color: Custom, be selected by Architect, and to match the steel doors at the Owner's Residential House.

C. Exterior and interior exposed aluminum surfaces shall receive a Class I clear anodic coating conforming to AAMA 611, AA-M12C22A41. Exterior trim Stucco wrap at jamb/heads with ¼" steel plate sill, typical posder coat.

D. Color Anodized Finish: Comply with AAMA 606.1 or 608.1; AA DAF-45 M12C22A42/44, integral or electrolytically deposited color, architectural Class I anodic coating minimum 0.7 mil thick.

PART 3 - EXECUTION

3.01 PREPARATION

A. Aluminum Windows:
   1. Coat surfaces to be placed in contact with cement plaster with clear methacrylic lacquer if not organically coated.
   2. Where aluminum surface come in contact with metals other than stainless steel, zinc, or white bronze of small area, isolate the aluminum by one of the following methods:
      a. Paint the dissimilar metal with one of the specified coatings.
      b. Apply sealant between aluminum and dissimilar metal.
      c. Isolate dissimilar metal with nonabsorptive tape or gaskets.

B. Install self-adhering flashing into window openings as specified in Section 07 65 00, "Flexible Flashing and Underlayment," as indicated on the Drawings, and recommendations of AAMA 2400.

C. Before inserting frame, apply heavy bead of polyurethane sealant as specified in Section 07 92 00, "Joint Sealants," on inside face of nailing fin around sides and top of window.

D. Where priming is required, priming shall be applied before sash is installed.

3.02 INSTALLATION

A. Install window units, hardware, and other components of work as shown on accepted shop drawings and as required for weather-tightness and water-tightness in accordance with manufacturer's instructions.

B. Set windows into opening, and press into place. Windows shall be plumb, level, and true to line, without warp or rack of frames or sash.

C. Anchor securely in place by nailing integral nailing fin to framing as recommended by window manufacturer. Seal fastener penetrations.

D. Additional interior and exterior perimeter sealing shall be as indicated, conforming to requirements specified in Section 07 92 00, "Joint Sealants." Give special attention to proper cleaning of painted aluminum surfaces in contact with sealant.

E. Install operating hardware. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and weathertight closure.

F. Install operating hardware not previously installed in shop. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and weathertight closure.

3.03 FIELD QUALITY CONTROL

A. Water Leakage: Windows shall be field tested to evaluate installed performance.
   1. Initial test shall be at first windows of each material or type installed on Project.
   2. Test in accordance with AAMA 502 after completion of installation and curing of sealants.
   3. Tests shall be observed by an independent inspector at Contractor's expense.
   4. Correct deficiencies, and modify system at no additional cost to Owner. Retest to assure no leakage.
   5. Testing does not relieve warranty responsibility required for watertightness.

B. Acoustical: Window units may be subject to field testing at Contractor's expense by an approved acoustical testing laboratory using portable sound level meters to verify conformance with required minimum sound-loss rating.
   1. If window units are determined by testing laboratory to not meet required sound-loss rating, Contractor shall, at no additional cost to Owner, modify or replace them, as directed by Architect, and shall retest until they meet the required sound-loss rating.

3.04 CLEANING AND TOUCH-UP

A. Protect installation from damage by tools, plaster, lime, acid, cement, or other compounds.

B. Leave specified labels in place, intact, and legible until review and acceptance of installation.

C. After inspection and acceptance of installation, remove labels, protective wrapping, and other foreign materials from glass and frame surfaces.

D. Clean glass and metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01 74 23, "Final Cleaning."

E. Touch up field abrasions and damage to factory-painted finish. Touch-up shall be unnoticeable in completed installation.

END OF SECTION

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following, but is not necessarily limited to:

1. Door Hardware, including electric hardware.
2. Storefront and Entrance door hardware.
3. Thresholds, gasketing and weather-stripping.
4. Door silencers or mutes.

C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.

1. Division 8: Section - Steel Doors and Frames.
2. Division 8: Section - Wood Doors.
3. Division 8: Section - Aluminum Storefront
4. Division 28: Section - Fire/Life-Safety Systems & Security Access Systems.

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

A. 2022 California Building Code, CCR, Title 24.

B. BHMA – Builders' Hardware Manufacturers Association

C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

D. DHI – Door and Hardware Institute

E. NFPA - National Fire Protection Association.

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

F. UL - Underwriters Laboratories.

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

G. WHI - Warnock Hersey Incorporated

H. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.

B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Submit schedule organized vertically into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

1. Include a Cover Sheet with;

a. Job Name, location, telephone number.
b. Architects name, location and telephone number.
c. Contractors name, location, telephone number and job number.
d. Suppliers name, location, telephone number and job number.
e. Hardware consultant's name, location and telephone number.

2. Job Index information included;

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

3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)					
			(a) 1 Single Door #1 - Exterior from Corridor 101	(b) 90°	(c) RH

				(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea		(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea		Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

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

D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.

F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.

I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.

J. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.5 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service

performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

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

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

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

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

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

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

1.6 DELIVERY, STORAGE AND HANDLING

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

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

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

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

1.7 WARRANTY

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

1. Mechanical Locksets: Ten (10) years.
2. Electro-mechanical locksets: Three (3) years
3. Closers: Thirty (30) years
4. Mechanical exit devices: Ten (10) years
5. Electro-mechanical exit devices: Five (5) years
6. All other hardware: Three (3) years.

1.8 MAINTENANCE

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

1.9 PRE-INSTALLATION CONFERENCE

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

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

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Item	Manufacturer	Acceptable Substitutes
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal
Closers	LCN	Or Approved Equal

Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Dust Proof Strikes	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.2 MATERIALS

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

1. Hinges shall be sized in accordance with the following:

a. Height:
1) Doors up to 42" wide: 4-1/2" inches.
2) Doors 43" to 48" wide: 5 inches.

b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.

2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Floor Closers: Shall be equipped with compression springs, cam and roller operating mechanism and a one piece spindle-cam for maximum operating performance and longevity.

C. Pivots: High strength forgings and castings with precision bearings for smooth operation. Positive locking vertical adjustment mechanism to allow installer to precisely position the door and balance the load.

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

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

1. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:

    a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
    b. Offset lever pull – minimum 1,600 foot pounds without gaining access
    c. Vertical lever impact – minimum 100 impacts without gaining access

2. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
3. UL 10C for 4’-0” x 10’-0” 3-hour fire door.
4. Cylinders: Refer to “KEYING” article, herein.
5. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
6. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
7. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw capable of UL listing of 3 hours on a 4’ x 10’ opening. Provide proper latch throw for UL listing at pairs.
8. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
9. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
10. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
11. Provide wired electrified options as scheduled in the hardware sets.

    a. 12 through 24 volt DC operating capability, auto-detecting
    b. Selectable EL (fail safe)/EU (fail secure) operating mode via switch on chassis
    c. 0.230A (230mA) maximum current draw
    d. 0.010A (10mA) holding current
    e. Modular / “plug in” request to exit switch

12. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.

F. Exit devices: Von Duprin as scheduled.

1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
3. Mechanism case shall have an average thickness of .140".
4. Compression spring engineering.

5. Non-handed basic device design with center case interchangeable with all functions.
6. All devices shall have quiet return fluid dampeners.
7. All latchbolts shall be deadlocking with ¾" throw and have a self-lubricating coating to reduce friction and wear.
8. Device shall bear UL label for fire and or panic as may be required.
9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130" thickness, match lockset lever design.
11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
12. Furnish glass bead kits for vision lites where required.
13. All Exit Devices to be sex-bolted to the doors.
14. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.

    a. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.

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

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

automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. Per 11B-404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.

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

I. Thresholds: As Scheduled and per details.

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

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

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

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

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

2.3 KEYING

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

B. A detailed keying schedule is to be prepared by the owner and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.

C. Extend the original Schlage masterkey system established for the project.

D. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).

E. Furnish Patent Protected Schlage keys and cylinders on all locks.

F. Furnish construction keying for doors requiring locking during construction.

G. Furnish all keys with visual key control.

1. Stamp key “Do Not Duplicate”.
2. Stamp (BHMA) key symbol on key.

H. Furnish all cylinders with visual key control.

1. Stamp (BHMA) key symbol on side of cylinder (CKC).

I. Furnish mechanical keys as follows:

1. Furnish 2 cut change keys for each different change key code.
2. Furnish 1 uncut key blank for each change key code.
3. Furnish 6 cut masterkeys for each different masterkey set.
4. Furnish 3 uncut key blanks for each masterkey set.
5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
6. Furnish 1 cut control key cut to each SKD combination.
7. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.
8. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
9. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.

J. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.

1. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.
2. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
3. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.

K. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.

1. Furnish CL100PB for use with non-I/C Schlage cylinders.
2. Furnish CL771R for use with FSIC Schlage cylinders.
3. Furnish CL721G for use with SFIC Schlage cylinders.

2.4 FINISHES

A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.

B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.

C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.5 FIELD QUALITY CONTROL

A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.6 SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.

C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Abbreviation	Name
GLY	Glynn-Johnson Corp
IVE	H.B. Ives
LCN	LCN Commercial Division
SCE	Schlage Electronic Security
SCH	Schlage Lock Company
VON	Von Duprin
ZER	Zero International Inc

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GROUP NO. 01

4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-L-KC-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 XQ11-948 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

GROUP NO. 02

4	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	CLASSROOM SECURITY	ND78P6D RHO 47342586	626	SCH
2	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

GROUP NO. 03

2	EA	CONT. HINGE	224XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
2	EA	PANIC HARDWARE	CDSI-PA-AX-98-L-KC-06	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
2	EA	MORTISE CYLINDER	26-091 XQ11-948 ICX	626	SCH
5	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
2	EA	FLOOR STOP	FS444	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BLK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

GROUP NO. 04

2	EA	CONT. HINGE	224XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-L-KC-06	626	VON
1	EA	PANIC HARDWARE	PA-AX-98-EO	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 XQ11-948 ICX	626	SCH
3	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
2	EA	FLOOR STOP	FS444	626	IVE
1	SET	MEETING STILE	328AA-S	AA	ZER
1	SET	SEAL SET	WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		
1	EA	MULLION SEAL	8780NBK PSA	BLK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

GROUP NO. 05 - Not Used

GROUP NO. 06

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

GROUP NO. 07

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	FLOOR STOP	FS439	682	IVE
3	EA	SILENCER	SR64	GRY	IVE

GROUP NO. 08

4	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

GROUP NO. 09

4	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	ND78P6D RHO 47342586	626	SCH
2	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
1	EA	FLOOR STOP	FS439	682	IVE

GROUP NO. 10

4	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	ND78P6D RHO 47342586	626	SCH
2	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH TBWMS	689	LCN

GROUP NO. 11

4	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBWMS	689	LCN
1	EA	FLOOR STOP	FS439	682	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

GROUP NO. 12

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH TBWMS	689	LCN
1	EA	GASKETING	188SBK PSA	BK	ZER

GROUP NO. 13

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-PA-AX-98-L-KC-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH TBWMS	689	LCN
1	EA	ELECTRONIC KEYPAD	KP2000E 10-30 VDC/12-24 VAC	628	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC BUZZER BY OTHERS	LGR	SCE

GROUP NO. 14

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

GROUP NO. 15

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50P6D RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	FLOOR STOP	FS439	682	IVE

GROUP NO. 16

8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
2	EA	OH STOP	90S	630	GLY
1	EA	ASTRAGAL	44STST OR BY HM DOOR MFR	STST	ZER
2	EA	SILENCER	SR64	GRY	IVE

GROUP NO. 17

HARDWARE BY ROLL UP DOOR MFR

GROUP NO. 18 - Not Used

GROUP NO. 19

4	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	PA-AX-98-L-BE-F-06	626	VON
1	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
1	EA	FLOOR STOP	FS439	682	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

END OF SECTION

SECTION 088000
GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Glass and glazing materials.
   2. Unframed mirrors. Factory-glazed window and door units shall conform to the requirements of this Section.

C. Related Requirements:

   1. Joint Sealants: Section 07 92 00.
   2. Hollow Metal Doors and Frames: Section 08 11 13.
   3. Aluminum-Framed Entrances and Storefronts: Section 08 41 13
   4. Aluminum Windows: Section 08 51 13.
   5. Toilet Accessories: Section 10 28 13; framed mirrors.

1.02 REFERENCES

A. American National Standards Institute (ANSI): Z97.1, "Performance Specifications and methods of Test for Transparent Safety Glazing Material Used in Buildings."

B. American Society for Testing and Materials (ASTM):
   1. C509: "Specification for Cellular Elastomeric Preformed Gasket and Sealing Material."
   2. C1036: "Standard Specification for Flat Glass."
   3. C1048: "Standard Specification for Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass."
   4. D2287: "Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds."
   5. E773: "Test Method for Seal Durability of Sealed Insulating Glass Units."
   6. E774: "Specification for Sealed Insulating Glass Units."

C. Consumer Products Safety Commission (CPSC): 16 CFR, Part 1201, "Safety Standard for Architectural Glazing Materials."

D. Glass Association of North America (GANA):
   1. Glazing Manual.
   2. Sealant Manual.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 33 00, "Submittal Procedures."
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures” and Section 01 78 36, “Warranties.”

B. Attendance is required at preconstruction meetings specified in related Section s.

1.04 ACTION SUBMITTALS

A. Shop Drawings: As specified in related Sections for systems in which glazing is installed.

B. Product Data: Manufacturer's literature for all materials proposed for use, substantiating that glass and glazing materials comply with specified requirements.

C. Samples:
   1. Glass:
      a. Sample, 12 inches square, of each type specified, except clear single-pane units.
      b. Thickness of tinted-glass samples shall be representative of thickness intended for installation.
      c. Samples of insulating glass shall be constructed from same material and by method as to be installed in Project.
   2. 12-inch-x-12-inch piece of each type of window film applied to proposed glass.
   3. Sealants and Gaskets:
      a. Sample, 12 inches long, of each type of sealant and gasket, including molded corners, exposed to view.
      b. Install sealant or gasket sample between two strips of material representative of adjoining framing system, in color.
   4. Samples may be submitted as part of sample submittals required under other Sections.

1.05 INFORMATIONAL SUBMITTALS

A. Statement of fabricator/installer qualifications for exterior glazing.

B. Statement of qualifications for applicator of applied film.

C. Product Certificates and Statements:
   1. Insulating Glass: Certification that units meet IGMA Class CBA requirements.
   2. Mirrors: Certification that mirrors meet requirements of the Safety Glazing Certification Council (SGCC).
   3. Neoprene: From manufacturer, stating that neoprene materials conform to specified standards.
   4. Sealants: The following statements for the installation:
      a. Statement signed by installer and Contractor, that sealants installed comply with Specifications and that installation methods comply with manufacturer's written instructions for each condition of installation and use on this Project.
      b. Structural Sealant: The following from the manufacturer:
         1) Compatibility: Materials in contact with structural sealant are compatible therewith after 21 days' exposure to ultraviolet light (2000 to 4000 microwatts of UV radiation).
         2) Stress: Joint dimension, when subjected to 1.5 times specified wind load pressure and seismic drift, will not cause sealant stress to exceed 20 psi, with a safety factor as recommended, in writing, by sealant manufacturer.

D. Test Reports: Statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

E. Design Calculations for Exterior Glass: Demonstrate compliance with applicable codes and specified structural and deflection requirements. Calculations shall be by a structural engineer licensed in the State of California.

F. Where conformance with specified deflection criteria results in different thickness of glass in the same building elevation, it shall be brought to the attention of the Architect in writing so that options for dealing with resulting different appearance can be considered.

1.06 CLOSEOUT SUBMITTALS

A. Extended warranty for insulating glass.

B. Cleaning and maintenance instructions for applied window films.

1.07 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator/Installer of Exterior Glazing: Company specializing in work of this Section, with [not less than 10 years'] documented experience on jobs of similar type and complexity.
   2. Applicator of Applied Window Film: Approved by film manufacturer.

B. Regulatory Requirements:
   1. Comply with CBC Chapter 24, Section 2406.
   2. Where safety glass is indicated or required, provide type of products indicated that comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category I or II materials, as applicable.
   3. Mirrors shall meet CPSC or ANSI safety glazing requirements and shall be certified by the Safety Glazing Certification Council (SGCC).

C. Industry Standards:
   1. Insulating glass shall be certified under a certification program approved by the Insulating Glass Manufacturers Alliance (IGMA).
   2. Comply with GANA "Glazing Manual," except where more stringent requirements are indicated.
   3. Comply with applicable provisions of the AAMA "Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual."

D. Minimum Wind Load for Exterior Glass and Glazing Assemblies: In accordance with CBC Chapter 16.

E. Sealant Compatibility and Adhesion Testing:
   1. Submit samples of all glass, gaskets, glazing accessories, and glass framing members proposed for use in contact with or in proximity to glazing sealants to the sealant manufacturer for compatibility and adhesion testing in accordance with sealant manufacturer's standard testing methods and the following requirements:
      a. Durability Test: Bond cohesion; after testing, cut samples lengthwise, and examine for bubbles.
      b. Adhesion in Peel: Each individual test; peel strength not less than 20 pounds per inch and no adhesion loss.
      c. Past Performance Tests: Not acceptable, except for uncoated-glass-to-uncoated-glass condition.
   2. Schedule sufficient time for testing and analysis of results to prevent delay in progress of work.
   3. Investigate materials that fail compatibility or adhesion tests, and obtain sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
   4. Submit certification of compatibility as specified above.

F. Mock-ups: Provide glazing for mock-ups specified in related Sections[, including site mockup specified in Section 01 4339, “Mock-ups.”

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass with manufacturer's label indicating type, quality, and thickness on each piece.

B. Protect glass and glazing materials during delivery, storage, and handling so as to comply with manufacturer's directions and as required to prevent face and edge damage to glass and damage to glass and glazing materials from effects of moisture, including condensation and other causes.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.09 WARRANTY

A. Manufacturers:
   1. Insulating Glass: Written warranty for sealed insulating glass unit in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period.
      a. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions
      b. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
      c. Warranty Periods:
         1) Vertical Glazing: 10 years from date of Substantial Completion.

B. In addition, warranty requirements of related Sections for systems in which glazing is installed shall apply to work of this Section.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE REQUIREMENTS

A. Provide watertight and airtight installation of each piece of exterior glass and sealed glass unit.

B. Coordinate with work of other Sections for weathertight installation at interface with other materials and systems.

C. Each installation shall withstand local normal thermal movement, temperature changes, wind loading, and impact loading (for operating sash and doors) without failure of any kind, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, loss of hermetic seal, deterioration of glazing materials, and other defects.
   1. Normal thermal movement is defined as that resulting from an ambient temperature range of 120 degrees F and from a consequent temperature range within glass and glass framing members of 180 degrees F.

D. Comply with applicable design and performance requirements of related Sections for systems in which glazing is installed.

E. Deflection Criteria: Glass center deflection at code required design load shall not exceed 3/4 inch.

2.02 GLASS MATERIALS

A. General: Except as otherwise specified, minimum thickness as scheduled on the Drawings unless otherwise recommended by fabricator for size of light to be glazed and design criteria.
   1. Where multiple sizes occur in a glazed element or assembly, provide a uniform glass thickness where the thickest required glass shall govern throughout.
   2. All tinted glass of the same color shall be the same thickness.

B. Annealed Float Glass: ASTM C1036, Type I, Class 1, Quality q3 or better.

C. Heat-Strengthened and Tempered Float Glass: ASTM C1036, Type I float glass as specified above and conforming to requirements of ASTM C1048 and as specified.
   1. Tempered glass shall meet ANSI Z97.1 test requirements.
   2. Glass shall be tempered using the roller hearth method.
   3. Heat-strengthened glass shall have surface compression levels between 3500 and 7000 psi.

D. Insulated Glass Type 1: Clear Low-E insulating units.
   1. Product: Vitro Sb70; PPG; SolarBan 70XL, or equal.
   2. Makeup: Two lites of clear float glass separated by a hermetically sealed air space with Low E coating on No. 2 surface: nominal 1 inch unit thickness: air-filled.

E. Transparent Mirror Glass: Pilkington LOF "Mirropane T.M. Transparent Mirror" or equal, 1/4 inch thick. Provide as tempered glass where required by code. The quality of the coating shall meet the requirements of ASTM C1376, "Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass."

F. Fire-Rated Glass: UL and WHI listed Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.; 1/4 inch thick "SuperLite I" as distributed by SAFTI*First* Division of O'Keeffe's Inc., San Francisco, CA, 415-822-4222.

G. Fire Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.

H. Fire-Rated Glass: 1/4 inch thick, clear, 20-minute fire rated; "Pyroswiss" produced by Giesbrecht AG and distributed by O'Keeffe's Inc.

I. Interior Insulating Glass Units, for acoustical insulation.

2.03 GLASS TYPES

A. See Drawings for Glass Types. (See Drawings Glass Schedule.)

2.04 GLAZING MATERIALS

A. Sealants for Glazing:
   1. Provide as specified in Section 07 92 00, "Joint Sealants."
   3. Exterior Locations: One-part, gun-grade silicone; Momentive Performance Materials "SCS-1200," Dow-Corning "999 Building Sealant," or accepted equal.

a. Color: Black .

B. Joint Backer: Diameter size at least 25 percent larger than joint width; type and material as recommended, in writing, by glass and sealant manufacturer.

C. Silicone Glazing Materials: Provide silicone setting blocks, jamb blocks, and sealant joint backer or spacers in lieu of neoprene, if recommended by sealant manufacturer, for compatibility with sealant. Corners, sizes, profiles, and color as specified for neoprene glazing materials.

D. Glazing Blocks and Spacers: Closed-cell neoprene complying with ASTM C509, in black color.

E. Stainless Steel Glazing Channel: Type 302/304; “CRL Stainless Steel Channel,” or accepted equal

F. Aluminum Glazing Channel:

G. Mirror Adhesive: "Mirro-Mastic" by Palmer Products Corp. or accepted equal.

H. Accessory Materials: Miscellaneous clips and fastenings as required and as standard with window or door manufacturer.

2.05 FABRICATION

A. Glazing framing dimensions shall provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerances. Provide correct glass size for each opening, within tolerances and necessary dimensions established.

B. Factory-label each pane of glass. Do not remove labels until final acceptance is obtained.

C. Tempered glass shall be horizontally tempered with roller ripples in horizontal direction.

D. Edge Treatment:

E. Clear glass for shelves and transaction surfaces shall be fabricated from specified tempered glass with exposed edges seamed before tempering, thicknesses as indicated.

F. Dimensional Tolerances: Glass shall comply with referenced standards, except for the following:

G. Sealed Insulating Glass Units:

H. Glass Bending:

I. Organic-Coated Mirrors: Provide backing tape on back of mirrors that are less than 36 inches above finished floor so as to keep glass fragments together should mirrors be accidentally shattered; "CRL" shatterproof safety tape as manufactured by C.R. Laurence Co., 800-421-6411, or accepted equal.

PART 3 - EXECUTION

3.01 GLAZING

A. Comply with combined printed recommendations of glass manufacturers and manufacturers of sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

B. Tempered Glass: Provide at locations where indicated and required in accordance with regulatory requirements.

C. Transparent mirror glass shall be installed with the coated surface facing the observed or subject side of the glazing.

D. Protect glass from edge damage during handling and installation.
   1. Use a rolling block in rotating glass units to prevent damage to glass corners.
   2. Use suction cups to shift glass units within openings.
   3. Do not raise or drift glass with a pry bar.
   4. When glass has flares or bevels along one horizontal edge that would occur in vicinity of setting blocks, install with flares or bevels at top of opening.
   5. Use glazing tape and shims to position glass properly.

E. Remove and dispose of glass with edge damage or other imperfections of any kind that, when installed, would weaken glass and impair performance and appearance.

F. Install setting blocks of proper size at sill, located one-quarter of glass width from each corner, unless otherwise required. Set blocks in sealant acceptable for heel bead use.

G. Provide edge blocking to comply with requirements of GANA "Glazing Manual," except where otherwise required by glass fabricator.

H. Set units in each series with uniformity of pattern, draw, bow, and similar characteristics.

I. Compression Gaskets: Provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.

J. Butt [and Structural] Glazing Sealant:

K. Putty: Use to seal inside of glass at steel sash.

L. Mirror Adhesive: Apply in accordance with manufacturer's recommendations over primer/sealer on substrate.

M. Applied Films: Apply in accordance with manufacturer's specifications.

3.02 PROTECTION AND CLEANING

A. Do not apply markers to surfaces of glass.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

D. Remove nonpermanent labels, and wash glass on both faces by method recommended by glass manufacturer. Comply with the additional requirements of Section 01 7423, "Final Cleaning."

END OF SECTION

SECTION 089101
LOUVERS AND VENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fixed aluminum louvers and frames.
   2. Supports and brackets as shown in Drawings and as needed for installation.
   3. Metal mesh screens shall be included.

B. Related Requirements:
   1. Metal Fabrications: Section 05 50 00.
   2. Sheet Metal Flashing and Trim: Section 07 62 00.
   3. Joint Sealants: Section 07 92 00.
   4. Mechanical Drawings: Division 23: Heating, Ventilating, And Air-Conditioning (HVAC); louvers connected to ductwork.

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 605.2: "Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels."

B. Building Services Research and Information Association (BSRIA).

C. ASTM International (ASTM):
   1. B221: "Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes."

1.03 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 33 00, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures,” and Section 01 7836, “Warranties.”

1.04 ACTION SUBMITTALS

A. Shop Drawings: Indicate louver layout plan and elevations; opening and clearance dimensions; tolerances; head, jamb, and sill details; blade configuration; screens; blank-out areas required; frames; and anchorage and interface with adjoining materials.

B. Product Data: Manufacturer's installation instructions and descriptive data of louvers, including standard drawings and free area of louvers.

C. Samples: 12-inch length of specified louver blade in specified finish.

D. Sustainable Design:
   1. General:

a. Submit information necessary to establish and document compliance with the California Green Building Code.

1.05 INFORMATIONAL SUBMITTALS

A. Quality Control: Manufacturer's certification that louvers comply with requirements and are licensed to bear the AMCA seal, based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.

1.06 CLOSEOUT SUBMITTALS

A. Closeout: Extended warranty.

1.07 QUALITY ASSURANCE

A. Louvers shall meet requirements for HEVAC Certification for architectural louvers.

1.08 FIELD CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate with installation of exterior wall finish.

1.09 WARRANTY

A. Manufacturer: Furnish Owner with manufacturer's written 20- year warranty for aluminum finish against defects in materials and workmanship, including against delamination or pitting of finish.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Structural Performance: Provide louvers capable of withstanding effects of gravity loads and stresses within limits without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.

B. Louver Performance: When a 4- by 4-foot louver is tested using AMCA Standard 500 and beginning of water penetration is 0.01-ozs-per-sq.ft free area, provide the following performance:
   1. Air Volume Flow Rate: 6,300-cu-ft-per-min., at beginning point of water penetration
   2. Pressure Drop: less than 0.10-inch w.g. (intake or exhaust) at beginning point of water penetration
   3. Blade vibration or noise: Unnoticeable.

2.02 MANUFACTURERS

A. Louvers: Airolite Company, Construction Specialties Inc. (C/S), Ruskin or Equal

2.03 MANUFACTURED UNITS

A. Wall Louver Type A: Ventilating, stationary, continuous blade aluminum louver: Airolite Company Model CB6386, or accepted equal.
   1. Frame Depth: 6 inches.
   2. Frame Thickness: 0.081 inches.
   3. Blade Thickness: 0.081 inches.
   4. Blade Angle: 39 degrees.
   5. Percent Free Area: 50 percent.
   6. Mullions: Concealed.
   7. Corners: Mitered.
   8. Provide with manufacturer's optional offset flange for installation at framed wall locations.

B. Exhaust Vent: Heavy-gage aluminum; Model SFX by Seiho International, Inc., or accepted equal.
   1. Size: 4 or 6 inches as required to match diameter of duct.
   2. Finish: As selected by Architect.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221, 6063-T52 alloy.

B. Fasteners: Stainless steel or aluminum.

2.05 ACCESSORIES

A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.
B. Fasteners and Anchors: Stainless steel.
C. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.
   1. Flashing Felt: Imperforate asphalt saturated felt, ASTM D 226
D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.06 FABRICATION

A. Shop-fabricate louvers in such a manner as to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Maintain equal blade spacing.

C. Frame: Channel shape with mechanically fastened corner joints.

2.07 FINISH

A. Finish – Typical:
   1. Primer: Manufacturer's standard epoxy prime coat.
   2. Finish Coat: High-performance fluoropolymer coating containing minimum 70 percent polyvinylidene fluoride (PVDF) resin ("Kynar 500"/"Hylar 5000") and meeting or exceeding all the requirements of AAMA 26205; PPG Industries "Duranar," or equal as standard with louver manufacturer.
      a. Color: Custom, as selected by Architect.

B. Finish at Louvers Interfacing with Curtain Wall Framing: To match; see curtain wall Specification Section.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check openings so as to assure that dimensions conform to Drawings.

B. Ensure that openings are free of irregularities that would interfere with installation.

3.02 INSTALLATION

A. Install louver assembly level and plumb as indicated on Drawings.

B. Follow procedures in manufacturer's recommended installation instructions.

C. Install flashings and align louver assembly so as to ensure moisture shed from flashings and diversion of moisture to exterior. Coordinate installation with installation of head and sill flashing as specified in Section 07 62 00, "Sheet Metal Flashing and Trim."

D. Seal perimeter interior and exterior with sealant specified in Section 07 92 00, "Joint Sealants."

3.03 ADJUSTING AND CLEANING

A. After initial inspection, remove labels, protective coating, and other foreign materials from aluminum surfaces.

B. Clean metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01 7423, "Final Cleaning."

C. Field touch-up of factory-applied finish will not be allowed.

D. Touch up minor field abrasions and damage to factory-painted finish. Touch-up shall be unnoticeable in completed installation.

END OF SECTION

SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Section Includes: Metal framing of interior nonbearing vertical and horizontal surfaces.

B. Related Requirements:
2. Structural Metal Stud Framing: Section 05 41 00; load-bearing framing at exterior walls.
3. Hollow Metal Doors and Frames: Section 08 11 13.
4. Gypsum Board: Section 09 29 00.
5. Acoustical Insulation and Sealants: Section 09 82 00; acoustical accessories including spring hangers and resilient sound isolation clips at ceilings.

1.02 REFERENCE STANDARDS

C. American Society for Testing and Materials (ASTM):
1. A307: "Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile."
2. A653: "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process."
3. C645: "Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board."
4. C754: "Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board, Standard Specification."
5. C955: "Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases."
6. C1002: "Specification for Steel Drill Screws for the Application of Gypsum Board."
7. E119: "Method for Fire Tests of Building Construction and Materials."

D. American Welding Society (AWS):
8. D1.1, "Structural Welding Code - Steel."

E. Steel Stud Manufacturer's Association (SSMA):
9. ICC-ES Legacy Report 4943P.
10. Technical Notes: "Interior Non-Structural 30 Mil Framed Walls."

F. Underwriters Laboratories Inc. (UL).

1.03 ADMINISTRATIVE REQUIREMENTS

G. Submittal Procedures:
1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

1.04 ACTION SUBMITTALS

H. Product Data:
1. Specifications and installation instructions for each type of steel stud required to show compliance with specified requirements.
2. Manufactured top track for deflection relief, with UL approval data for each required condition and fire rating.

I. Sustainable Design:
1. General:
a. Submit information necessary to establish and document compliance with the California Green Building Code.
b. Sustainable design submittals are in addition to other submittals.
c. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with the California Green Building Code requirements.

1.02 INFORMATIONAL SUBMITTALS

A. Qualification data for design engineer.

1.03 QUALITY ASSURANCE

A. Qualifications:
1. Installer: Company specializing in work of this Section with minimum 3 years' documented experience.
2. Design Engineer: Professional structural or civil engineer registered in the State of California or shall otherwise be acceptable to governing authorities. Design engineer shall be experienced in providing engineering services for the installations of metal framing systems similar to those indicated for this Project in material, design, and extent.

B. Regulatory Requirements:
1. Comply with fire-resistance ratings as indicated and as required by governing authorities and CBC.
2. Provide materials, accessories, and application procedures that have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.
3. Framing system shall conform to ICC-ES Report for stud gage and spacing for all wall conditions.

C. Comply with American Welding Society (AWS) D1.1, "Structural Welding Code - Steel" for welding.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect metal studs and related materials from rusting and damage.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Metal Stud Systems: Cemco, ClarkDietrich Building Systems, Knorr Steel Framing Systems, Steeler, Inc., or accepted equal.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Seismic Performance: Non-structural metal framing shall withstand the effects of anticipated earthquake motions for the Project. See also the Structural Drawings.

B. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated. Assembly shall be tested in accordance with ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Wall Systems: Select steel studs in accordance with the manufacturer's standard load tables and the following design pressures and deflections:
   1. Typical Partitions: L/240 at 5 psf.
   2. At Stairs and Vertical Shafts: L/240 at 10 psf.

2.03 COMPONENTS

A. General:
   1. Metal studs, track, and sheet metal furring channels shall comply with ASTM C645.
   2. Gage identification shall be color coded in accordance with ASTM C955.
   3. Metal components used at moist and wet areas shall have a G60 galvanized coating thickness.

B. Prefabricated, Steel Studs:
   1. Fabricate from cold-formed steel; ASTM A653.
      a. 0.0677 Inch and 0.0538 Inch (14 and 16 Gage): SQ Grade 50.
      b. 0.0428 Inch (18 Gage): CQ Grade 33.
      c. 0.0329 Inch and 0.0179 Inch (20 and 25 Gage): CQ Grade 33 or in equivalent metal thickness using “UltraSTEEL” EQ or equivalent dimpled sheet metal.
   2. Width: As indicated on the Drawings.
   3. Shape: Roll-formed channel with punched openings along web and knurled flanges.
   4. Finish: Galvanized, minimum G-40 coating meeting ASTM A653 and C955.

C. [Ceiling Joists: 0.0538 inch (16-gage) steel C-shaped section with punched webs and 1-5/8-inch plain or perforated flanges to receive screws, ASTM A568 or A570 Grade 50, galvanized in accordance with ASTM A653 with G-60 coating.]

D. Floor and Top Tracks:
   1. Fabricate from cold-formed steel; ASTM A653.
   2. Grade to match stud used.
   3. Minimum Thickness: Gage equal to or heavier than stud used.
   4. Width: Acceptable stud manufacturer's regular type or proper width for stud specified.
   5. Shape: Snap-in type, formed with slots or prongs so as to hold stud securely in place. Where required for fire rating, use shape formed for use with stud shoes and wire ties in order to hold studs securely in place.
   6. Top Track for Deflection Relief: "MaxTrak 2D (SLP/H)”, slotted deflection and drift track by Clark Dietrack Framing Systems, or accepted equal.
      a. Rated Partitions: When tested in accordance with UL 2079 for cyclical movement and subsequently tested in accordance with the time temperature curve of ASTM E119

and ASTM E814, system shall meet requirements for 1 and 2 hour fire resistance rated construction and to requirements of hose steam resistance.
b. Provide sliding clips and other accessories as required for a complete installation.

7. Finish: As specified for studs.

E. Channels:
1. Cold-Rolled Channels: 16 gage (minimum 0.053-inch thick), with factory-applied, rust-resistant paint.
a. [Minimum Weight per 1,000 Lineal Feet:
1) Depth 3/4 Inch: 300 pounds.
2) Depth 1-1/2 Inches: 475 pounds.]
2. Furring Channel, Screwable Type: 25 gage (minimum 0.0188 inches), cold-formed galvanized steel, hat shaped, 7/8 inch deep, with plain or knurled face to receive screws.
3. Resilient Furring Channels: 2-5/8 inch, 25-gauge steel (minimum 0.0210 inch thickness), 1/2 inch deep asymmetric-shaped channel complying with ASTM C645, with a single slotted leg 1-1/2 inch screw flange; ClarkDietrich “RC Deluxe” (RCSD) or equal demonstrating equivalent metal thickness and laboratory acoustical performance.

F. Partition Stiffeners or Bridging: Specified cold-rolled channels or stud; manufacturer's standard bridging for approved stud.

G. Partition Strapping: 2-inch-wide metal strap, same gage as studs.

H. Barrier Mesh for Security: High-strength expanded metal mesh intended for this use.
1. Construction: Carbon steel mesh complying with ASTM F1267, Type II, Class 1, carbon steel mesh.
2. Minimum Thickness: 0.068 inch (13 gage).
3. Diamond Size: 3/4 inch, with 74 percent open area.
4. Weight: 75 pounds per 100 square feet, minimum.
5. Provide with compatible clips for installation.
6. Manufacturers and Products:
a. Basis of Design: “Barrier Mesh BM75” by ClarkDietrich.
b. Additional Acceptable Products: "Barrier Mesh" by Metalex, A Unit of Jason Incorporated, or equal.

I. Wire: ASTM A641, Class 1 zinc coating, soft temper.
1. Bracing Wire: Minimum 0.106-inch nominal diameter (12 gage).
2. Tie Wire:
a. Single Strand: Minimum 0.062-inch nominal diameter (16 gage).
b. Double Strand: Minimum 0.048-inch nominal diameter (18 gage).

J. Clips for fastening furring channels to carrying channels shall be standard product of the gypsum board manufacturer intended for this use.

K. Fasteners: ASTM C1002; Self-drilling and self-tapping, No. 10 flat pan-head screws.

L. Anchorage Devices:

M. Backing Plates: Provide as indicated on the Drawings.

N. Welding Electrodes: Comply with requirements of AWS.

O. Top Track Gasket: Fire rated, thin profile, intumescent cover consisting of a 0.040 inch (1 mm) thick intumescent matrix in a 3.5 mil thick polyethylene cover; “SpeedFlex Track Top

Gasket (TTG)" by Specified Technologies, Inc., 800-992-1180, or equal complying with the following.

P. Furnish miscellaneous components as required for completion of installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting structure and conditions under which metal support systems will be installed.

3.02 GENERAL REQUIREMENTS

A. Comply with requirements of ASTM C754.

B. Wire Tying:
1. Use single-strand 16-gage or double-strand 18-gage tie wire.
2. Splicing: Double-wrap-tie.
3. Horizontal Stiffeners to Channel Brackets: Figure-eight tie.
4. Framing Members Perpendicular to Each Other: Saddle tie.

C. Deflection Relief at Non-Load-Bearing Walls and Partitions: Provide specified manufactured system for top track for deflection relief unless otherwise shown.
1. Cut studs short where abutting underside of steel construction.
2. Do not abut end studs to steel walls.
3. Secure ends of horizontal stiffeners to abutting steel or walls and columns.

3.03 INSTALLATION OF FIRE-RATED ASSEMBLIES

A. Install studs that are components of fire-rated partition in accordance with the requirements of governing authorities and codes.

B. Provide manufactured top track designed for deflection relief at top of fire-rated partitions.

3.04 APPLICATION OF FURRING CHANNELS

A. Space hat-shaped furring channels at 16 inches on center unless otherwise shown.

B. Secure furring with specified screws through holes in channel mounting flange.

C. Attach resilient furring channels at 16 inches on center, perpendicular to support framing with mounting flanges facing in only one direction
1. Hold back ends of channels 1/2 inch from intersecting surfaces.
2. Splice channels only at framing support. Overlap butt ends and drive screws through both flanges.

3.05 ERECTION OF NON-STRUCTURAL STUDS

A. Tracks:
1. Align floor and top tracks.

2. Where studs run to structure, attach tracks to structure at maximum of 24 inches on center for powder-driven fasteners and 48 inches on center for expansion bolts, unless otherwise indicated.
3. Where studs run to a point just above ceiling line, anchor and/or brace as required to meet the design criteria.

B. Studs:
1. Plumb and align studs.
2. Space studs [as indicated on the Drawings. Use the following for heavy wall facing such as 12 inch square ceramic tile or stone tile.
3. Where tile or stone is used on walls, decrease spacing or increase gage as required by tile or stone installer.
4. Attach studs to tracks by method recommended by stud manufacturer.
5. Do not splice studs. [If necessary, splice studs by nesting, with minimum lap of 8 inches.]
6. At wall-mounted fixtures, casework, shelving, equipment, handrails, and grab bars, provide 16-gage or heavier studs at least 3-5/8 inches wide.

C. Horizontal Strapping: Place straps both sides of studs where unsupported height of studs exceeds 4 feet.

D. Horizontal Stiffeners: Brace studs with steel channel stiffeners placed horizontally at midpoint of the stud slot on inside of partition, if indicated on the Drawings or if recommended by the stud manufacturer. Secure as recommended by the stud manufacturer.

E. Install diagonal bracing at locations indicated or as required for frame stability and to resist seismic and lateral loads.

F. Weld Connections: Resistance-spot or projection-weld, fillet-weld, or plug-weld in accordance with recommended procedures and practices of AWS.

G. Framing Around Metal Frames for Doors and Sidelights:
1. Install double stud at each jamb of metal frame, continuous for full height of partition.
2. Secure Wire-tie stud to jamb anchors with screws.

H. Provide stiffener 18 inches above floor; 12 inches and 27 inches below top of frame. Securely anchor spacers and adjacent studs to each other.
1. Attach section of track horizontally to head of frame.
   a. Install cripple studs at 16 inches on center maximum over head of frame [and below sidelight openings].
   b. Attach to head track, and anchor top of cripple studs in same manner as provided for full studs.

I. Reinforce cripple studs with steel channel horizontal stiffener.
1. Locate not more than 6 inches above frame for opening.
2. Extend horizontal stiffener at least two full stud spaces, three full-height studs, beyond each side of opening.
3. Wire-tie each cripple stud and full stud crossed by horizontal stiffener.

J. Wall Intersections and Ends:
1. Form corners and intersections of partitions with three studs.
2. Place studs forming internal corners 2 inches from point of partition intersection.

K. Provide backing plates in wall to support wall-mounted items, including but not limited to wall-mounted casework, shelving, fixtures, equipment, handrails, grab bars, toilet accessories, and other locations as required by the various Sections of the Work.
   1. [Attach backing plates, as specified, to carry loads required by CBC.
   2. Provide supplemental studs as required.

L. At walls that support wall-mounted items such as handrails, casework, or shelving and that do not extend to deck, brace studs to building structure so as to meet specified deflection criteria.

M. Framing at Curved Partitions:
   1. Cut runner track at 2 inches on center at outside edge, and bend to radius indicated on the Drawings.
   2. Provide 1-inch-by-25-gage metal strap, clinched to inside of leg of runner, in order to span gaps at outside edge.
      a. Secure to vertical leg of track with metal lock fasteners.
      b. Start first strap minimum 4 inches before beginning of radius.
   3. [Curved tracks shall be preformed to "templates," field or shop welded. Do not use field-snipped or field-bent track.]
   4. Space studs at 6 inches on center, a minimum of 1-foot tangent to arc (prior to starting of curve).
   5. Reduce standard stud spacing on arc so as to prevent flat areas between framing but not more than 12 inches on center.
   6. At Contractor's option, track may be bent to required radius in shop.

3.06 HORIZONTAL FRAMED SURFACES

A. Frame with specified joists, minimum 6-inch size, at 16 inches on center and as required to limit deflection as specified in Part 2 above.

B. Provide runner channels to receive framing at ceiling and walls of same gage as studs. Secure with mechanical fasteners at 24 inches on center maximum. Secure studs to channels with screws.

C. Frame with joists of size, gage and spacing indicated on the Drawings.

END OF SECTION

SECTION 092900
GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Gypsum board, including finishing.
   2. Metal accessories.

B. Related Requirements:
   1. Access Doors and Panels: Section 08 31 00.
   2. Gypsum Sheathing: Section 06 16 43.
   3. Thermal Insulation: Section 07 21 17.
   4. Firestopping: Section 07 84 00; fire-rated sealants.
   5. Access Doors and Panels: Section 08 31 00.
   6. Non-Structural Metal Framing: Section 09 22 16; metal wall and ceiling framing including manufactured suspensions system for perforated gypsum board.
   7. Tiling: Section 09 30 00.
   8. Acoustic Insulation and Sealants: Section 09 82 00; acoustical sealants and sound control requirements.
   9. Painting and Coating: Section 09 90 00.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C11: “Standard Terminology Relating to Gypsum and related Building Materials and Systems.”
   2. C442: "Specification for Gypsum Backing Board and Coreboard."
   3. C475: "Specification for Joint Treatment Materials for Gypsum Wallboard Construction."
   4. C557: "Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing."
   5. C645: "Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board."
   6. C840: "Specification for Application and Finishing of Gypsum Board."
   7. C1002: "Specification for Steel Drill Screws for the Application of Gypsum Board."
   8. C1047: "Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base."
   9. C1396: "Specification for Gypsum Board."
   10. E119: "Method for Fire Tests of Building Construction and Materials."

B. Gypsum Association (GA):
   1. GA-214: "Recommended Specification: Levels of Gypsum Board Finish."
   2. GA-216: "Recommended Specifications for the Application and Finishing of Gypsum Board."

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data for the following system materials suitable to show compliance with requirements.
   1. Each type of board material.
   2. Metal accessories, if other than listed products are to be provided.

B. Samples: Each type or configuration of extruded aluminum reveal finished as specified, including intersections and other special components.

C. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications, if requested by Architect.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in work similar to that required on this Project, with not less than 5 years of documented experience.

B. Notify District's Representative prior to covering or enclosing framing, ducts, and pipes in sound-rated construction in order to allow for on-site review and correction if required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials in dry location, fully protected from weather, direct exposure to sunlight, and damage from other construction activity.

B. Stack gypsum board products flat and level, properly supported in such a manner as to prevent sagging or damage to ends and edges.

C. Store metal accessories so as to prevent bending, sagging, distortion, or other mechanical damage.

D. Do not store or stack gypsum board on floors with an equivalent loading in excess of 50 pounds per square foot.

1.07 FIELD CONDITIONS

A. Ambient Conditions: Maintain temperature and humidity conditions in installation area in accordance with GA-216 requirements.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Regulatory Requirements:
   1. Fire-Resistance Ratings:
      a. Comply with fire-resistance ratings as indicated and required by governing authorities and codes.
      b. Provide materials, accessories, and application procedures that have been listed by a nationally recognized testing agency or tested according to ASTM E119 for type of construction shown.
   2. Comply with the CBC, Chapter 25.

B. Industry Standards: Work shall comply with the applicable requirements of GA publication GA-216 and GA-214.

2.02 MATERIALS - GENERAL

A. Provide products manufactured by or recommended by manufacturer of gypsum board in order to maintain single-source responsibility.

B. Provide materials in accordance with ASTM C840.

C. Provide boards in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

D. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

A. Gypsum Board: ASTM C1396; USG “Sheetrock,” or accepted equal.
   1. Thickness: 5/8 inch unless otherwise shown.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Moisture- and Mold-Resistant Board: ASTM C1396; USG “Sheetrock Mold Tough,” or accepted equal.
   1. Thickness: 5/8 inch, unless otherwise noted.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
   3. Mold Resistance: 10 on scale of 10 in when tested accordance with ASTM D3273.
   4. Moisture Resistance: The average water absorption for panels shall not exceed 5 percent by weight after two-hour immersion when tested in accordance with ASTM C473.

C. Fire Rated Gypsum Board: ASTM C1396, Type X, unless more stringent type required by code; USG “Sheetrock Firecode Core,” or accepted equal.
   1. Thickness: 5/8 inch, unless otherwise noted.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

D. Fire-Rated Moisture- and Mold-Resistant Board: ASTM C1396, Type X, unless more stringent required by code; USG “Sheetrock Mold Tough Firecode Core,” or accepted equal.
   1. Thickness: 5/8 inch, unless otherwise noted.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
   3. Mold Resistance: 10 on scale of 10 in when tested accordance with ASTM D3273.
   4. Moisture Resistance: The average water absorption for panels shall not exceed 5 percent by weight after two-hour immersion when tested in accordance with ASTM C473.

2.04 ACCESSORIES

A. Adhesives:
   1. Laminating Adhesive: As recommended by gypsum board manufacturer for laminating gypsum board together in fire-rated construction.
   2. Adhesives shall comply with required VOC regulations.

B. Fasteners:
   1. Screws: Phillips head with bugle shape, Type W, conforming to ASTM C1002.
   2. Sizes of fasteners shall be as required by code and as recommended by wallboard manufacturer.

C. Concealed Metal Reinforcements and Casing: Electrogalvanized, conforming to ASTM C1047. Provide products equivalent to the following:
   1. Exterior Corner: United States Gypsum (USG) "Dur-A-Bead."
   2. Intersection of Gypsum Board with Dissimilar Material: USG No. 200-B "L" shaped trim and 200-A "J" shaped trim.
   3. Control Joint: USG No. 093.

D. Joint-Treatment Materials:
   1. Manufacturer: Same as gypsum board.
   2. Comply with ASTM C475 and with manufacturer's recommendations for specific project conditions.
   3. Joint Tape: Manufacturer's standard paper type.
   4. Joint Compound: Vinyl-based, ready-mixed type for interior use and as follows:
      a. Taping Compound: Specifically formulated for embedding tape and accessories and for prefilling.
      b. Topping Compound: Specifically formulated for finishing drywall over taping compound.
      c. At joints and fasteners in moisture-and-mold-resistant gypsum board intended for tile surfacing, provide compound specifically recommended or permitted by manufacturer of board.

E. Miscellaneous Items: Furnish components not specified but shown on the Drawings and other items required to complete the installation.

PART 3 - EXECUTION

3.01 APPLICATION OF GYPSUM BOARD

A. General: Comply with ASTM C840, GA-216, and CBC. Where UL designs are indicated on the Drawings for fire-rated partitions, comply with UL requirements, except where exceeded by other requirements.
   1. Wherever possible, install gypsum board in such a manner as to minimize butt end joints.
   2. Install wall boards in such a manner as will minimize butt end joints in center of wall area. Stagger vertical joints on opposite sides of walls. Stagger horizontal joints where required by governing code.
   3. Place wrapped edges adjacent to one another. Do not place cut edges or butt ends adjacent to wrapped edges.
   4. Support all edges and ends of each board on framing or by solid substrate, except that long edges at right angles to framing members in non-fire-rated construction may be left unsupported, unless required by governing code.

B. Single-Layer Application:
   1. Install gypsum board by means of screw attachment.
   2. On walls and partitions, plan installation so that leading edge or end of gypsum board is attached to open end of stud flange first.
   3. Do not locate screws attaching gypsum board to channels within 2 inches of framing.

C. Double-Layer Application:

1. Apply base layer vertically, offsetting vertical joints at least one stud space between layers.
2. Install base layer by means of screw attachment. Provide fire taping only.
3. Fit face layer by laminating to base layer with adhesive.
4. At Contractor's option, provide permanent support by attaching face layer to base layer with screws in accordance with manufacturer's instructions.

D. Installation of Backing Board: Install specified moisture-and-mold-resistant board at partitions to receive tile in accordance with manufacturer's recommendations for installation, including minimum clearances and sealing of penetrations and edges.

E. Perforated Acoustical Board: Install by means of screw attachment to ceiling framing specified in Section 09 22 16, “Non-Structural Metal Framing.”
   1. Fastener heads and joints shall be filled with compound provided by, or recommended by, board manufacturer and joints tapped and finished as specified.

F. Metal Trim:
   1. Apply trim at all exterior corners and at interior corners where gypsum board intersects metal or other dissimilar material.
   2. Provide control joints in accordance with ASTM C840 recommendations.
   3. Edges:
      a. Apply applicable shape of metal edge trim at exposed edges of wallboard.
      b. Gypsum Board Abutting Other Materials: Install edge trim with 1/8-inch clearance to allow for sealant.
      c. Apply neoprene tape to assure sealed joints at abutting surfaces.

G. Control Joints:
   1. Provide control joints in accordance with ASTM C840 recommendations, where and where otherwise shown and specified.
   2. Location shall be approved by the District’s Representative.

H. Remove and replace sheets damaged in handling or installation.

I. For conditions not specified or shown on the Drawings, follow procedures recommended by the gypsum board manufacturer.

3.02 SOUND-RATED CONSTRUCTION

A. Comply with requirements for sealing penetrations at sound-rated construction as specified in Section 09 82 00, “Acoustical Insulation and Sealants.”

3.03 FIELD QUALITY CONTROL

A. Construction Tolerances:
   1. Gypsum board surfaces to be painted shall have no measurable variation in any 2-foot direction and a maximum variation of 1/8 inch in 10 feet 0 inches when a straightedge is laid on the surface in any direction.
   2. See Section 09 30 00, “Tiling” for tolerances required for surfaces to receive tile.
   3. Do not exceed 1/16-inch offset between planes of abutting sheets at edges or ends.

3.04 TAPING AND FINISHING

A. General Requirements:

1. Apply finishing compounds in accordance with manufacturer's directions. Do not apply tape and joint compound over joints containing acoustical sealant until the sealant has completely cured.
2. Conceal flanges of metal reinforcement with minimum two coats compound. Compound shall extend 8 to 10 inches each side of metal nosing.

B. Level of Finishes: In accordance with GA-214.
1. At Locations Indicated to Receive "Fire-Taping" and at Unexposed Gypsum Board Applications: Level 1.
2. Locations to Receive Tile or Applied Paneling: Level 3.

3. Typical Locations to Receive Flat or Eggshell Paint, or Wall Coverings: Level 4.
4. Surfaces to Receive Semi-Gloss or Gloss Paint (Except Utilitarian Areas such as Storerooms): Level 5.

END OF SECTION

SECTION 093000
TILING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Tile: Ceramic, ceramic mosaic, and quarry tile for floor, wall, and interior applications.

B. Cementitious backer board as tile substrate.

C. Coated glass mat backer board as tile substrate.

D. Stone thresholds.

E. Ceramic trim.

F. Tile edging and cove base profiles.

1.2 RELATED REQUIREMENTS

A. Division 01 for - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 5400 - Cast Underlayment.

C. Section 08 3100 - Access Doors.

E. Pertinent Sections specifying work penetrating tile surfaces.

1.3 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.
3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement.
4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.
5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.
7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.

8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.
10. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.
11. ANSI A118.3 - American National Standard Specifications for Chemical Resistant Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.
12. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.
13. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
14. ANSI A118.9>ANSI A108/A118/A136.1 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
15. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation.
16. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.
17. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles.
18. American National Standard Specifications for Polymer Modified Cement Grouts for Tile Installation A118.7
19. American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-set Ceramic Tile and Dimension Stone Installation A118.10

B. Manufacturer's specifications and recommendations for mounting in exterior or wet areas.

C. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

D. California Code of Regulations, Title 24, Part 2, California Building Code (CBC), International Building Code.

E. California Code of Regulations, Title 24, Part 11 California Green Building Standards Code, "CAL-Green".

F. Division of the State Architect Interpretation of Regulations (IR) 23-3: Approved Alternate for Toilet Room Curb, latest edition.

G. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.4 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

1. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

B. Module Size: Actual tile size plus joint width indicated.

C. Face Size: Actual tile size, excluding spacer lugs.

D. Large Format Tile: Tile that is greater than 15 inches (381 mm) in width or length.

E. Wet Area: Includes tile surfaces that are either soaked, saturated, or regularly and frequently subjected to moisture such as tub enclosures, showers, swimming pools, commercial kitchens and exterior areas.

1.5 SUBMITTALS

A. See Division 01 for - Submittal Procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, grout sealer and accessories. Include instructions for using grouts and adhesives.

1. Identify additional requirements and areas where manufacturer's installation instructions differ from TCNA documents.

C. Product data for tile edging and cove base profiles, including material, finish, and installation instructions.

C. CAL-GREEN Submittals:

1. Product Data – VOC Limits: For adhesives, sealants, fillers, primers and coatings, documentation including printed statement of VOC contents, comply with limits specified in related section.

1.6 QUALITY ASSURANCE

A. Maintain one copy of the most recent edition of ANSI A108/A118/A136.1 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience with specified products including all trims and accessories.

1.7 MOCK-UP

A. See Division 01 for - Quality Control, for general requirements for mock-up.

B. Construct tile mock-up in a mutually accepted location, incorporating all components specified for the location. Minimum size 8 feet long by full height of indicated tile extent.

C. Approved mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing, foreign matter or other causes.

1. Provide heated and dry storage facilities on site.

B. Package labeling in accordance with ANSI A137.1. Retain labels and packaging until disposal is authorized by Architect.

C. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Do not use frozen materials.

D. Deliver and store materials on site at least 24 hours before work begins.

1.9 FIELD CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. VOC Limits for adhesives, sealants, fillers, primers and coatings. Comply with limits specified in related section.

B. Slip Resistance: For tile installed on walking surfaces, stair treads and landings, provide products with the following values as determined by testing identical products per ANSI A137.1-2012, Section 9.6

1. Method: Dynamic Coefficient of Friction DCOF AcuTest method, wet test using 0.05 percent sodium lauryl sulfate solution.
2. Application: Level interior flooring surface
3. Tested value: 0.42 or greater

C. Expansion Joints: In accordance with EJ-171 of the Tile Installation Handbook. Provide at expansion joints in the backing materials, cold joints in concrete substrate or where backing materials change.

1. Exterior Work and Interior Wet Locations: Provide on all surfaces maximum 12-feet on center in both axes.
2. Interior Work, not otherwise specified: Provide on continuous floor areas at intervals of 24-feet.

D. Wainscots: Make top course full uncut tile. Extend wainscot to higher elevation by adding horizontal courses of tile as required to completely surround access panels, switch or outlet covers with finished tile. Do not permit these items penetrating tile surfaces to split the boundary of the tile surface.

2.2 TILE

A. General:

1. Field and accent tiles shall be of the same caliper.
2. Each room with tile in each building shall have a separate color scheme.
3. Field colors to be selected from price group 2, accent colors to be selected from premium price groups. Allow for one accent color to be selected from price groups 3 or 4, minimum per tile type at each separate location unless noted otherwise below.

B. Manufacturers: All products by the same manufacturer.

1. American Olean Corporation: www.americanolean.com/#sle.
2. Dal-Tile Corporation: www.daltile.com/#sle.
3. Interceramic: www.interceramicusa.com.
4. Roca Tile USA: www.rocatilegroup.com
5. Substitutions: See Division 01 for - Product Requirements.

C. Ceramic Mosaic Tile: ANSI A137.1, standard grade.

1. Shape: Square.
2. Edges: Square.
3. Surface Finish: Unglazed.
4. Color: a. Field: Selected by Architect from Price Group 2. b. Accent: Selected by Architect from Price Group 3 or 4.
5. Pattern: As indicated; if none indicated, allow for field and accent colors. (two colors) and request pattern.
6. Trim Units: Matching bead, cove, and surface bullnose shapes in sizes coordinated with field tile.
7. Products: a. Daltile; Keystones™.

D. Glazed Wall Tile: ANSI A137.1, standard grade.

1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
2. Size: 4-1/4 by 4-1/4 inch, nominal.
3. Edges: Cushioned.
4. Surface Finish: High gloss.
5. Color: Field colors To be selected from manufacturer's standard range Price Group 2, and two accent colors selected from premium Price Groups.
6. Pattern: As indicated; if none indicated, allow for field and two accent colors (three colors) and request pattern.
7. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.

E. Glazed Wall Tile: ANSI A137.1, and as follows:

1. Size and Shape: 3 inch x 6 inch, 4-1/4 inch x 4-1/4 inch, 6 inch square. As indicated on Drawings, except if no size is shown, provide 4-1/4 inch x 4-1/4 inch.
2. Thickness: 5/16 inch.
3. Edges: Cushioned.
4. Surface Finish: Glazed.
5. Color: a. Field: Selected by Architect from Price Group 2. b. Accent: Selected by Architect from Price Group 3 or 4 (full range of available colors).
6. Pattern: As indicated; if none indicated, allow for field and accent colors, (two colors) and request pattern.
7. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.

8. Products: a. Daltile; Semi-Gloss™ and Semi-Gloss™ Color Trends. b. Substitutions: See Division 01 for - Product Requirements.

F. Glazed Wall Tile: ANSI A137.1, and as follows:

1. Size and Shape: 3 inch x 6 inch, 4-1/4 inch x 4-1/4 inch, 4-1/4 inch x 8-1/2 inch, 8 inch square, 6 inch x 8 inch, 8 inch square. As indicated on Drawings, except if no size is shown, provide 6 inch x 6 inch.
2. Thickness: 5/16 inch.
3. Edges: Cushioned.
4. Surface Finish: Glazed.
5. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.
6. Products: a. Daltile; Festiva™. b. Substitutions: See Division 01 for - Product Requirements.

2.3 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.

1. Applications: a. Open Edges: Bullnose. b. Inside Corners: Coved. c. Floor to Wall Joints: Cove base.
2. Manufacturers: Same as for tile.

B. Thresholds: Marble, white or gray, honed finish; 2 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.

1. Applications:

   a. Custom Building Products; EBMLite - Lightweight Epoxy Bonding Mortar or CEG-Lite Lightweight Commercial Epoxy Grout - Setting and Grouting Epoxy www.custombuildingproducts.com.

   b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.

   c. Substitutions: See Division 01 for - Product Requirements.

C. Metal Tile Profiles

1. Tile edging and cove base: Profiles as detailed in Drawings to address required transitions.
   a. Stainless steel finish as selected by Architect
   b. Basis of design: Schluter Systems

D. Thin and Medium-Bed, Polymer fortified and Kevlar reinforced Latex-Portland Cement Mortar which complies with requirements in ANSI A118.4, ANSI A118.11 and ASTM C627.

1. Applications: Where indicated on drawings and as required by TCNA methods specified.
2. Provide product that is approved by manufacturer for application thickness up to 3/4 inch (19 mm) and system warranty of Twenty-Five Years.

3. Products: a. Laticrete International, Inc.: LATICRETE MultiMax 255.

F. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.

1. Products: a. Custom Building Products; Thick Bed Bedding Mortar: www.custombuildingproducts.com. b. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: www.laticrete.com/#sle. c. Mapei; 4 To 1 Mud Bed Mix: www.mapei.com. d. Substitutions: See Division 01 for - Product Requirements.

2.5 GROUTS

A. Manufacturers:

1. Custom Building Products: www.custombuildingproducts.com
2. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
3. Mapei Corporation: www.mapei.com.
4. Substitutions: See Division 01 for - Product Requirements.

B. Water-Cleanable 100 percent Epoxy Grout: ANSI A118.3, ANSI A118.5 & ISO 13007-3 RG requirements with a VOC content of 65 g/L or less and a System Warranty of Twenty-Five Years.

1. Manufacturers: a. Laticrete International, Inc. LATICRETE SPECTRALOCK 2000 IG Premium Grout. b. Equivalent product by Custom or Mapei.

2.6 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.

1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products: a. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle. b. ProSpec, an Oldcastle brand; ProColor Advantage Caulk: www.prospec.com. c. Substitutions: See Division 01 for - Product Requirements.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout that does not change color or appearance of grout. Colorless, no-sheen, water-based penetrating slip and stain-resistant sealer, not affecting color or physical properties of surfaces as recommended by tile manufacturers..

1. Composition: Water-based colorless silicone.
2. Products: a. Aqua Mix® Sealers Choice® Gold as manufactured by CUSTOM Building Products, www.custombuildingproducts.com www.custombuildingproducts.com. b. DuPont™ StoneTech® Professional Impregnator Pro® Sealer as manufactured by Dupont, www2.dupont.com as supplied by Laticrete, www.laticrete.com. c. MAPEI Corporation, www.mapei.com, Ultracare™ line of products. d. Miracle, www.miraclesealants.com, Impregnator 511 (Original). e. Substitutions: See Division 01 for - Product Requirements.

2.7 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12, intended as waterproofing.

1. Type: Fluid-applied.
2. Thickness: 20 mils, maximum.
3. Crack Resistance: No failure at 1/16 inch gap, minimum.
4. Products:

    a. Custom Building Products; FractureFree: www.custombuildingproducts.com.
    b. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
    c. Mapei;

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Fluid or Trowel Applied Type: a. Material: Synthetic rubber. b. Thickness: 25 mils, minimum, dry film thickness. c. Products:
   a. Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
   b. LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
   c. Substitutions: See Division 01 for - Product Requirements.

C. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Fluid or Trowel Applied Type: a. Material: Synthetic rubber. b. Thickness: 25 mils, minimum, dry film thickness. c. Products:
    1. Custom Building Products; Redgard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com.
    2. LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
    3. Substitutions: See Division 01 for - Product Requirements.

D. Cleavage Membrane Under Thick Mortar Bed:

1. Material: No. 15 asphalt saturated felt.

E. Reinforcing Mesh: 2 by 2 inch size weave of 16/16 wire size; welded fabric, galvanized.

F. Membrane at Walls:

1. Material: 4 mil thick polyethylene film.

G. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:

1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
2. Uncoupling Function: Allow for separation between membrane and the mortar adhering tile to the membrane when subjected to excessive substrate movement.
3. Suitable for installation over green concrete.
4. Suitable for installation over wood-based substrates.

5. Type: Fluid or Trowel Applied. a. Products:
    1. Custom Building Products; Redgard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com.
    2. LATICRETE International, Inc; LATICRETE 125 Sound and Crack Adhesive: www.laticrete.com/#sle.
    3. Substitutions: See Division 01 for - Product Requirements.

H. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

I. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.

J. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

K. Cleaning solutions

1. Glazed tile: Acid or pH-neutral solutions as approved by the grout and tile manufacturers.
2. Unglazed Tile: Clean with pH-neutral solutions.

L. Tile Polish: As recommend by tile and grout manufacturers.

2.8 MIXES

A. Proportion and mix materials in accordance with manufacturer's instructions and applicable ANSI standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine, with installer present, surfaces to receive tile work and conditions under which work will be installed. Do not proceed with tile work until surfaces and conditions comply with requirements indicated in referenced tile installation standards and manufacturer's printed instructions. Prepared substrates to be in accordance with ANSI A108, A3.1 and The Council of North America (TCNA) recommendations.

B. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

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

D. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances. Shim wood framing substrates to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Blend tile before installation and ensure that variations are uniform in each location.

3.3 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCNA Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

1. Align joints when adjoining tile on floor, base, walls and trim are same size.
2. Layout tile work and center tile fields in both directions in each space or on each wall area.
3. Provide minimum 1/2 tile at field edges.
4. Adjust to minimize tile cutting. Provide uniform joint widths.

C. Place thresholds at exposed tile edges.

D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

F. Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

G. Form internal angles square and external angles bullnosed.

H. Accurately form intersections and returns.

1. Perform cutting and drilling of tile without marring visible surfaces.
2. Carefully grind cut edges of tile abutting trim, finish or built-in items to produce straight aligned joints.
3. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap tile.
4. Terminate tile at center line of doors, unless otherwise indicated.
5. Ensure that joints are symmetrical and that tile surfaces are plumb, true to line, and parallel to the room axis

J. Install thresholds where indicated.

L. Sound tile after setting. Replace hollow sounding units.

K. Install expansion and control joints in accordance with TCNA method EJ171.

L. Keep control and expansion joints free of mortar, grout, and adhesive.

M. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal without retention of water or ponding.

N. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

O. Grout tile joints. Conform to requirements of ANSI A108.10.

P. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

Q. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

1. Seal joint between wainscots and fixtures; seal around pipes penetrating wainscots. Tool exposed sealant joints to a uniformly smooth surface without laps, sags or depressions.

R. Grout Sealing: Test sealer before application and assure that sealer will not stain grout.

1. Test sealer before application and assure that sealer will not stain grout.
2. Seal joints between wainscots and fixtures, seal around pipes penetrating wainscots.
3. Tool exposed sealant joints to uniform smooth surface without laps, sags or depressions.

S. Cracked, split, chipped, misaligned or broken tiles will not be accepted in finished work.

3.4 INSTALLATION - WATERPROOF MEMBRANE

A. Install membrane per ANSI A108.13, ANSI requirements for thin-set methods and manufacturer's printed instructions. Provide fully watertight installation.

B. Install membrane with products or methods approved in writing by manufacturer when joining, sealing, fastening or adhering sheet membrane. Ensure full bedding of membrane into adhesive. Seal all laps.

C. Extend membrane up adjacent walls a minimum of 8 inches and greater where indicated; comply with DSA IR 23-3.

D. Coordinate membrane installation with installation of internal drains. Lap membrane and drain flange as required to direct all water to drain and maintain waterproof installation.

E. Upon completion of membrane work, plug drains or dam areas and fill with water. After 24 hours inspect for leakage. Make necessary adjustments to stop leakage and re-test until watertight.

3.5 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

3.6 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCNA Handbook Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. Grout with silicone rubber grout.

3.7 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA Handbook Method W244C, using membrane at toilet rooms.

B. Over coated glass mat backer board on studs, install in accordance with TCNA Handbook Method W245, using membrane at toilet rooms.

C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W211, bonded mortar bed without membrane.

3.8 GROUTING

A. Grout joints in accordance with manufacturer's instructions and ANSI A108.10.

B. Clean sanding water, dust, and foreign substances from joints to be grouted.

C. Clean and dry tile surfaces.

D. After grouting, remove all grout residue promptly.

3.9 TOLERANCES

A. Variation from Plumb: For vertical joints, external corners, and other conspicuous lines, do not exceed 1/8 inch in 10 feet.

B. Variation in Level: For horizontal joints and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 -inch (12 mm) maximum.

C. Maximum Variation of Surface Flatness For Tile Floors: 1/8 inch in ten feet, non-cumulative, free of ponding, all water flows to drains.

D. Maximum Variation of Surface Flatness For Tile Walls: 1/8 inch in ten feet, non-cumulative.

E. Variation in Plane between Adjacent Units (Lipping): Do not exceed the following dimensions between faces of adjacent units as measured from a straightedge parallel to stone finish surface:

1. Units with Polished Faces: 1/64 -inch (0.4 mm).
2. Units with Honed Faces: 1/32 -inch (0.8 mm).
3. Units with Sand-Rubbed Faces: 1/32 -inch (0.8 mm).
4. Units with Thermal-Finished Faces: Depth of thermal finish or 3/16 -inch (5 mm), whichever is less.

5. Units with Natural-Cleft Faces: Depth of natural-cleft finish or 3/16 -inch (5 mm), whichever is less.

F. Variation in Joint Width: Do not vary joint thickness more than 1/16 -inch (1.6 mm) or one-fourth of nominal joint width, whichever is less.

G. Correct surfaces if tolerances are not as specified.

H. Correct defects by removal and replacement of the defective work. Areas requiring correction work will be identified. Re-measure corrected areas for compliance.

3.10 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. Allow grout to cure 14 days before cleaning. Clean all ceramic tile surfaces so they are free of foreign matter. Flush surface with clean water before and after cleaning.

C. Clean tile and grout surfaces.

D. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.11 PROTECTION

A. Do not permit traffic over finished floor surface for 7 days after installation.

B. Floors: Protect from all traffic for at least 72 hours after installation.

1. Do not step on floor for at least 24 hours; if traffic is unavoidable after that, use plywood stepping boards.
2. Protect from heavy traffic for at least 7 days after installation.
3. When fast-setting materials are used to allow faster occupancy, comply with the manufacturer's recommendations.
4. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage and wear.

C. Walls: Protect from impact, vibration and heavy hammering on adjacent and opposite walls for at least 14 days after installation, unless manufacturer's instructions allow a shorter period.

D. Protect from food products and chemicals which can cause staining for at least 14 days.

E. Protect from freezing and total water immersion for at least 21 days after installation.

END OF SECTION

SECTION 095100
SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system, seismically restrained.

B. Acoustical units:

1. Acoustical Panels

2. Acoustical Baffles

1.02 RELATED REQUIREMENTS

A. Division 21: Pertinent sections specifying fire suppression work above and in ceilings.

B. Division 23: Pertinent sections specifying mechanical work above and in ceilings.

C. Division 26: Pertinent sections specifying electrical work above and in ceilings.

D. Division 27 and 28: Pertinent sections specifying signal and fire alarm work above and in ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

D. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.

E. UL (FRD) - Fire Resistance Directory.

F. California Code of Regulations, Title 24, Part 11, California Green Building Standards Code, “CAL- Green”.

G. California Building Code (CBC), Title 24, Part 2, Section 1616A.

H. Division of the State Architect (DSA) Interpretation of Regulations (IR) 25-2.13: Metal Suspension Systems for Lay-In Panel Ceilings, 2013 CBC, revised 11-09-2017.

I. ASCE 7-10, Minimum Design Loads for Buildings and Other Structures, American Society for Civil Engineers

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

K. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Division 01, Submittals, for submittal procedures.

B. Provide complete submittals at the same time as submittals for work in related sections to permit review of complete and integrated systems and assemblies.

C. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, mechanical and electrical items installed in the ceiling, and locations and spacing of seismic restraint elements.

D. Product Data: Provide data on suspension system components and acoustical units.

F. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Acoustical Units, including the Blades: Quantity equal to 5 percent of total installed.

I. Manufacturer's recommendations for cleaning and refinishing acoustical units and suspension system, including precautions against materials and methods detrimental to finishes and acoustical performances.

1.06 QUALITY ASSURANCE

A. Conform to CISCA requirements.

B. Requirements of regulatory agencies: Conform to governing codes and regulations. All materials shall be UL tested, listed and labeled.

C. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 PROJECT CONDITIONS

A. Before installation acoustical material, ensure that temperature and humidity conditions approximate interior conditions to exist when room is occupied. Maintain conditions during and after installation.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 70 percent prior to, during, and after acoustical unit installation.

C. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

D. Acoustical Blades: Installation of the products shall be carried out where the temperature is between 32F(0C) and 120F (49C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning.

E. Handle acoustical blades carefully to avoid scratching or denting units in any way.

F. Install acoustical units after interior wet work, including painting and coating, is dry.

G. Protect completed work above suspension system from damage during installation of suspension system components.

1.08 WARRANTY

A. Blades: One (1) year from date of substantial completion, covering sagging and warping as a result of defects in materials or factory workmanship.

B. Suspension System: Ten (10) years from date of substantial completion, covering rusting and manufacturer's defects.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Design Load Requirements:
   1. Hangers and Connections: Capable of carrying at least five times design load indicated in ASTM C 635; and minimum of 100 pounds.
   2. Ultimate strength of connections in tension of at least 280 pounds or twice actual load whichever is greater.

B. VOC Limits for adhesives, sealants, fillers, primers and coatings. Comply with limits specified in related section.

C. Grid: True plane and level within tolerances specified.

D. Surface burning less than 25 in accordance with ASTM E 84.

2.02 ACOUSTICAL UNITS

A. Manufacturers:
   1. Approved equal.

B. Acoustical Units - General: ASTM E1264, Class A.

C. Acoustical Panels: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. Size: 24 by 48 inches.
   2. Thickness: 3/4 inches.
   3. Fire Hazard Classification: Class A (Flame spread 25 Smoke Developed 25 or under), UL Labeled, meeting ASTM E 1264 and E 84.
   4. Edge: Square.
   5. Surface Color: White.
   6. S1urface Pattern: Non-directional fissured.
   7. Product: Ultima by Armstrong.
      a. Substitutions: See Section 01 2513 – Product Options and Substitutions.

D. Acoustical Baffles:
   1. Product: Soundscapes by Armstrong or Equal
   2. Size: 10x46
   3. Color: To be selected from standard manufacturer colors
   4. Acoustics: Sound absorption up to 1.80 Noise Reduction Coefficient (NRC).
   5.

2.03 SUSPENSION SYSTEM

A. Suspension System - General: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and seismic clips as required. Pull-out tension values greater than 300 lbs.

B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.

C. Profile: Tee; 15/16 inch wide face.
   1. Construction: Double web.

D. Factory Finish: Painted, color as selected.

E. Product: Prelude XL by Armstrong. ICC-ESR-1308
   1. Main Runner: 7301.
   2. Cross Runner: XL7340.
   3. Seismic Clip: MB with ESR4 expansion sleeve.
   4. Wall Clip: BERC2

F. Product: ”DX 26 Heavy Duty” by U.S. Gypsum. ICC-ESR-1222
   1. Main Runner: DX26.
   2. Cross Runner: DX424.
   3. Seismic Clip: ACM7.
   4. Wall Clip ACM7

2.04 ACCESSORIES

A. Support Channels and Hangers, stabilizer bars, clips, splices: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Ceiling Suspension Wire: Class 1 zinc coated (galvanized) carbon steel conforming to ASTM A641- 09a, #12 gage with soft temper and minimum tensile strength = 70 ksi.

D. Galvanized Sheet Steel (including that used for metal stud and track compression struts/posts): ASTM A653-11, or other equivalent sheet steel listed in Section A2.1 of the North American Specification for the Design of Cold-Formed Steel Structural Members 2007, including supplement 2 dated 2010 (AISI S100-07/S2-10).
   1. Material 43 mil (18 gage) and lighter: minimum yield strength of 33 ksi.
   2. Material 54 mil (16 gage) and heavier: minimum yield strength of 50 ksi.

E. Electrical Metallic Tube (EMT): ANSI C80.3/UL 797 carbon steel with G90 galvanizing; minimum yield strength (Fy) of 30 ksi and minimum ultimate strength (Fu) of 48 ksi.

F. Sheet Metal Screws: ASTM C1513-10, ASME B18.6.4-89 (R2005). Length as required so that penetration of screws through joined material shall not be less than three exposed threads.

G. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

H. Touch-up Paint: Type and color to match acoustical and grid units.

I. Individual Suspension for Blades:

   1. Aircraft Cable: Armstrong Item 6655L8CR - 4-Point Hanging Kit, or Item 625530 - Extended Hanging Aircraft Cables.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions, as required by California Code of Regulations Chapter 2501.A.5, DSA IR-25-2 and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Coordinate layout with lighting fixtures, air outlets, partitions and other adjoining work.

E. In exitways install with a main runner or cross-runner surrounding all sides of each ceiling unit and each light fixture or grille.

F. Provide expansion joints at intersections and junctions of corridors, lobbies and other similar areas.

G. Attach surface mounted fixtures to the main runner with at least two positive clamping devices composed of minimum 14 gage steel. Rotational spring catches do not comply.

H. Locate concrete reinforcement and prestressing tendons by non-destructive means prior to installing post - installed anchors. Do not damage reinforcing or tendons by anchor placement.

I. Welding: In accordance with AWS D1.3 using E60XX series electrodes.

J. Seismic Restraints: install in accordance with ASTM E 580, referenced standards and governing codes.

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

L. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

M. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

N. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

O. Do not eccentrically load system or induce rotation of runners.

P. Perimeter Molding: Install with tight hairline joints at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install with continuous gasket.
   2. Use longest practical lengths.
   3. Overlap and rivet corners.
   4. Install with continuous gasket.
   5. Overlap and rivet corners

Q. Form expansion joints as detailed. Accommodate plus or minus movement as indicated and to conform to referenced requirements. Maintain visual closure.

3.03 FACILITY SERVICES WITHIN THE CEILING:

A. Positively attach all flexible sprinkler hose fitting mounting brackets, ceiling-mounted air terminals, light fixtures, and other similar facility service items to the ceiling suspension systems by means of screws or approved fasteners with a minimum of two attachments required at each component.

B. Provide #12 gage slack safety wire (s) attached from the service item to the structure above to each item as described below:
   1. Items weighing less than or equal to 20 lb. shall have one (1) safety wire.
   2. Items weighing more than 20 lb. but less than or equal to 56 lb. shall have two (2) safety wires (at diagonal corners).
   3. Items weighing more than 56 lb. shall be supported directly from the structure above by not less than four (4) taut #12 gage hanger wires or other approved hangers attached from the item to the structure above.

C. Miscellaneous Devices: Attach all lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, video cameras, etc., to the ceiling grid.
   1. For Devices weighing more than 10 lbs., provide #12 gage slack safety wire anchored to the structure above.
   2. For Devices weighing more than 20 lb., provide support independently from the structure above.

3.04 INSTALLATION - ACOUSTICAL UNITS and BLADES

A. Install acoustical units/blades in accordance with manufacturer's instructions.in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 TESTING

A. Perform all field testing in the presence of the project inspector.

B. Post-Installed Anchors in Concrete: Field test power actuated fasteners for 200 lbs. in tension.
   1. Hanger Wire Anchors: Test at a frequency of 10 percent.
   2. Bracing Wire Anchors: Test at a frequency of 50 percent in accordance with CBC Section 1913A.7.
   3. All Other Post-Installed Anchors: Test in accordance with CBC Section 1913A.7.

3.07 CLEANING

A. Comply with requirements of Section 01 7700.

B. Clean soiled surfaces in accordance with manufacturer's printed instructions. Remove and replace, with new materials, tiles and suspension systems that are damaged or cannot be acceptably cleaned to the Architect's satisfaction.

C. Repainting exposed parts of suspension system shall be with a paint type and application method recommended for use over metal surfaces.

D. Upon completion of the work, remove all materials, containers, equipment and debris. Leave area in a clean condition.

END OF SECTION

SECTION 096120
CONCRETE SEALER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Clear sealer applied to exposed interior concrete at stairs and other locations not scheduled to receive an applied flooring material.

B. Related Requirements:
   1. Cast-in-Place Concrete: Section 03 30 00.
   2. Painting and Coating: Section 09 90 00.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 30 00.

B. Coordinate application of sealer with accessibility striping at concrete fill on stairs.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each type of steel stud as may be required to show compliance with specified requirements.

1.04 INFORMATIONAL SUBMITTALS

A. Results of field slip-resistance testing.

1.05 FIELD CONDITIONS

A. Coordinate finishing of exposed concrete flatwork to receive sealer with surface textures specified under other Sections. A finished surface with specified slip-resistance as specified is required.

B. Protect exposed surfaces, both new concrete flat work and concrete where surface treatment is completed, to prevent damage by impact or stains from rubbish and the work of other trades.

1.06 QUALITY ASSURANCE

A. Mockup: Select a text area, in coordination with the Architect, as a test area to evaluate application procedure and appearance.
   1. Document application rate used for test area.
   2. Allow 5 to 7 days after application before evaluating test area.
   3. Evaluation of test area will be used to determine if more than one coat will be required.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Slip Resistance: Walking surface, after application of sealer, shall provide a value equal to or greater than 0.42 when tested in accordance under dry conditions with DCOF AcuTest procedure contained in ANSI A137.1:2012, Section 9.6, and under wet conditions with DCOF AcuTest procedure of ANSI B101.3.

2.02 MATERIALS

A. Sealing Compound at Exposed Concrete Flatwork: Low VOC, exempt solvent-based, non-yellowing, complying with ASTM C309, Type 1, Classes A & B; “Diamond Clear 350” by Euclid Chemical Company as scheduled and specified, or equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. When applying to freshly poured concrete as a cure and seal, the surface bleed water must be allowed to evaporate prior to applying sealer and the surface must be hard enough as to not be marred during product application.

B. When applying over cured concrete, sealer shall not be applied over stains, layout markings, oils, grease, wax, and other contamination caused by Contractor’s construction activities.
   1. Stains, layout markings, and contamination shall be thoroughly removed by the use of detergent scrubbing with a heavy duty cleaner/degreaser, low pressure water cleaning (less than 5,000 psi), steam cleaning, or chemical cleaning.
   2. If cleaning does not achieve an acceptable surface and remove contamination, provide additional surface preparation as approved by the Architect.

3.02 APPLICATION OF CLEAR SEALER

A. Apply specified sealer using an industrial, solvent-resistant pump-up sprayer with a high-solids nozzle and a short-nap, solvent-resistant roller for even distribution in accordance with manufacturer's instructions.

B. Maintain a “wet edge” while spraying, and immediately backroll over sprayer lap marks.

C. Redistribute puddles and runs before sealer dries.

D. Apply uniformly and with sufficient material for surface to remain wet for 30 to 60 seconds before penetrating.

E. Do not exceed manufacturer’s recommended application rate.

F. Apply second coat required to achieve appearance and sealing properties acceptable to Architect as determined during review of mockup.

3.03 PROTECTION

A. Protect exposed surfaces, as required to prevent damage by impact or stains from rubbish and work of other trades.

END OF SECTION

SECTION 096500
RESILIENT FLOORING AND BASE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Resilient sheet flooring.

2. Resilient tile flooring.

3. Resilient base.

4. Resilient edge trim and accessories.

B. Related Requirements:

1. Cast Underlayment: Section 03 54 00.

2. Refer to Construction Phasing Plans on the Drawings for specific requirements of multi-phased scope of work.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action and Informational Submittals shall be submitted in accordance with Section 01 33 00 “Submittal Procedures.”

2. Closeout Submittals shall be submitted in accordance with Section 01 77 00 “Closeout Procedures” and Section 01 78 36 “Warranties.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical data for each resilient product required. Include profiles of resilient edge strips and reducers.

B. Initial Samples: Manufacturer's standard color charts consisting of actual product samples, showing full range of colors and patterns available for each type of product required.

C. Verification Samples:

1. Each type, pattern, and color of resilient flooring material selected.

2. Tile: Full-size.

3. Accessories: 9 inches long by full dimension.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications.

B. Verification that flooring meets specified requirements for slip-resistance.

C. Results of substrate moisture content tests.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data, including list of recommended maintenance products and procedures for each type of resilient flooring material.

B. Extra materials as specified.

C. Manufacturer’s extended product warranties.

1.06 MAINTENANCE

A. Extra Materials:

1. Furnish additional floor-covering materials for replacement and maintenance.

2. Furnish, in factory-packaged and –labeled cartons, 5 percent of square footage of each size, color, pattern, and type of material included in the work. Tiles shall be submitted in full cartons.

3. Supply extra materials from same production lots and color runs as used in work.

4. Deliver the extra material to Project just prior to Substantial Completion, and store as directed by City.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: At least three installations of extent comparable to this Project.

B. If areas of concrete are not within the floor covering manufacturer's maximum allowable emission rate and slab area fails the moisture test, do not proceed with installation and notify the District Representative.

C. Dry or Wet Slip Resistance: A Pendulum Test Value (PTV) of 45 or greater under dry and wet conditions as tested using ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.

1. If manufacturer of selected resilient flooring does not have test data to substantiate compliance with the above testing methods and values, provide alternative testing to verify compliance as acceptable to governing authorities.

2. Laboratory tests shall be made on a minimum of three samples of each material and finish proposed for use.

D. Stain Removal: Samples of the product will be provided for stain removal testing by City.

1. Sample size shall be 24 inches by 24 inches, pre-cleaned by manufacturer per published recommendations. Samples shall have no coatings, sealers, floor finish or other manually or mechanically applied finish on the surface of the product.

2. Stain testing shall consist of application of common healthcare related disinfectants and chemicals to include, but not limited to, Betadine, Methylene Blue, Silver Nitrate and alcohol based hand sanitizer. Duration of test period shall be no less than one week. Removal of chemicals shall be in accordance with manufacturers published cleaning and maintenance recommendations.

E. Mockups: First installed area or example of each type of resilient flooring shall serve as a mockup for review and approval by District Representative of workmanship, visual effect, and interface with adjacent construction, including adjacent flooring.

1.08 FIELD CONDITIONS

A. Allow all flooring materials and adhesives to condition to the room temperature for a minimum of 48 hours before starting the installation.

B. Environmental Requirements:

1. Maintain temperature in spaces to receive resilient flooring between 70 and 90 degrees F for at least 24 hours before installation, during installation, and 48 hours after installation.

2. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation.

3. Maintain minimum temperature of 55 degrees F for remainder of construction period.

4. Do not install flooring when relative humidity exceeds 45 percent.

C. Install resilient flooring products after other finishing operations, including painting, have been completed.

1.09 WARRANTY

A. Manufacturers: Provide District with manufacturer’s written warranties as available and published for each resilient product.

PART 2 - PRODUCTS

2.01 FLOORING MATERIALS - GENERAL

A. Flooring shall:

1. Be uniform in thickness and size.

2. Have edges cut accurately and square.

3. Be uniform in color, with variations in variegated patterns kept to a minimum.

4. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

5. Provide each type of resilient product by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

2.02 TILE FLOORING

A. Static Control Vinyl Sheet Flooring:
   1. Basis of Design: Tarkett, Primo SD.
   2. Application: For use in IDF / Tech rooms.
   3. Color: Light Cool Beige 0564.
   4. Type: Static-dissipative (SD) homogeneous vinyl sheet flooring.
   5. Standard: ASTM F150.
   6. Electrical Resistance: 1 x 10^6 to 1 x 10^9 ohms.
   7. Thickness: 2.0 mm (0.080 inches).
   8. Size: 6' 7" (2m) wide rolls.
   9. Fire Performance: ASTM E648 Class I.

B. Solid Vinyl Tile Flooring:
   1. Solid Vinyl Floor Tile: Commercial grade luxury vinyl tile for glue down installation.
   2. Basis of Design: Design, Drawings, and Specifications are based on the following:
      a. Tarkett, Latitude
         - Subject to compliance with requirements, provide product indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”
      b. Tile Standard: ASTM F 1700, Class III, Solid Vinyl Tile.
      c. Type: B, Embossed Surface.
      d. Thickness: 0.2 inch (5 mm) overall thickness.
      e. Wear Layer Thickness: 20 mil (0.5 mm).
      f. Size: 6 inches by 48 inches nominal.
      g. Colors and Patterns: Lattitude, Suntoned Teak, PLWD 7523 WW.

2.03 WALL BASE

A. Resilient Base: ASTM F1861, Type TS, molded thermoset vulcanized rubber; as scheduled, Burke Flooring, or equal.

   1. Provide premolded internal and external corners, and exposed end units if available from manufacturer. Premolded units shall be ordered from same color run as base.

   2. Lengths: Roll.

   3. Color: As selected by District Representative.

   4. Typical Profile: Coved.

   5. Thickness: 0.125 inches (1/8 inch).

   6. Height: 4 inches, unless otherwise noted.

   7. Fire Performance Characteristics:
      b. Critical Radiant Flux: Class I material when tested in accordance with ASTM E648 (NFPA 253).
      c. Smoke Density: ASTM E662 (NFPA 258); 450 or less.

   8. Physical Properties:
      d. Hardness: ASTM D2240; 85 Shore A.
      e. Flexibility: Will not crack, break, or show any signs of fatigue when bent around a ¼

inch diameter cylinder.

2.04 ACCESSORIES

A. Adhesives:

1. Provide adhesives as recommended by manufacturer of resilient flooring material for conditions of installation and for each type of flooring.

2. Adhesive shall meet VOC requirements.

B. Integral Base Accessories: Provide manufacturer's standard cove support strips and finished metal top edge strips.

C. Top Edge Strip: Type and color as selected by City's Representative from manufacturer's full range of types and colors.

D. Edge Strips: Homogeneous vinyl or rubber, tapered or bullnose edge, color as selected by City's Representative.

E. Welding Thread: As supplied or recommended by sheet flooring manufacturer in color approved by City's Representative.

F. Subfloor Filler: White premixed latex-cement paste designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes; Ardex "SD-P Instantpatch," Burke, or equal acceptable to manufacturer of resilient flooring material furnished.

1. Use material capable of being applied and feathered out to adjacent floor without spalling.

G. Primers and Adhesives: Waterproof nontoxic types as recommended by flooring manufacturer for specified material and application.

H. Sealer and Wax: Type recommended by flooring manufacturer for material type and location.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect substrate in order to verify that it is satisfactory. Substrate shall be:

1. Free of excess moisture, as determined by testing.

2. Smooth and free of cracks, holes, ridges, coatings preventing adhesive bond.

3. Flat to within 1/8 inch in 10 feet and shall be such that finish floor will not show "telegraphing" of irregularities.

4. Free of other defects impairing performance or appearance.

3.02 SUBSTRATE PREPARATION

A. Suitability of Substrate:

1. Comply with ASTM F710 and manufacturer's recommendations for surface preparation.
   f. Remove protrusions, and grind smooth.

g. Apply patching compounds for filling small cracks, holes, depressions in subfloor where existing stacks have been removed, and to bring substrate to within specified tolerances and criteria.
h. Substrate shall be flat to within 1/8 inch in 8 feet and shall be such that finish floor will not show "telegraphing" of irregularities.

2. Remove coatings from previously installed flooring that might prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives.

3. Vacuum surfaces to be covered.

B. If required to ensure suitable adhesion and surface tolerances and flatness, provide mechanical preparation of the surface to an ICRI (International Concrete Repair Institute) CSP (Concrete Surface Profile) #3 or #4. Acceptable methods are by sanding or shot blasting. Other mechanical methods, if used, shall be acceptable to flooring manufacturer. Do not use chemical abatement methods.

C. Perform moisture and acidity tests on concrete surfaces to verify compliance with requirements for maximum moisture content and alkalinity range of flooring manufacturer.

D. Perform bond tests to ascertain presence of substances detrimental to obtaining adhesive bond.

E. Air-Moisture Content Testing: Determine relative humidity of air in rooms to receive resilient flooring, using wet-bulb and dry-bulb sling psychrometer, to verify that relative humidity does not exceed 45 percent.

F. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.03 APPLICATION OF ADHESIVES

A. Mix and apply adhesives in accordance with manufacturer's instructions. Prime surfaces if recommended by adhesive manufacturer.

B. Apply uniformly over substrates.

1. Cover only that amount of area that can be covered by flooring material within the recommended working time of adhesive.

2. Remove any adhesive that dries or films over.

3. Do not soil walls, bases, or adjacent areas with adhesive.

4. Promptly remove any spillage.

C. Apply adhesives with notched trowel or other suitable tool.

D. Clean trowel, and rework notches as necessary to ensure proper application of adhesive.

3.04 INSTALLATION OF SHEET FLOORING

A. Install flooring using adhesives, in accordance with manufacturer's instructions and reviewed submittals.

1. Lay all sheets in single length from wall to wall.

2. Extend flooring into recesses, door reveals, closets, and similar spaces. Resilient flooring shall fit neatly into doorframes and around corners and other obstructions.

3. Lay sheets with seams square to room axis. Match patterns at seams.

4. Install self-coved base where indicated on the Drawings. Provide cove filler strip backing at radius bend and a cap binding strip at the top edge.

B. Seams:

1. Provide welded seams. Comply with manufacturer's recommendations for welding.

2. Finish all seams flush and free from voids, recesses, and raised areas.

C. Finished floors shall be smooth and free from buckles, cracks, breaks, waves, and projecting edges.

3.05 INSTALLATION OF TILE FLOORING

A. General:

1. Lay tile from center of room or space, working toward perimeter.
   i. Lay tile parallel to room axis in straight courses, with cross joints perpendicular and straight.
   j. Lay tile with grain or pattern running in checkerboard pattern or in same direction, as directed by District Representative.
   k. Do not lay tile less than one-half width of a field tile, except where accepted by District Representative for irregularly shaped rooms or spaces.

2. Fit tile neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment. Cut tile neatly and accurately to fit within 1/64 inch of abutting surfaces.

B. Biobased Tile: Comply with the manufacturer’s installation instructions which include the following:

1. General:
   l. Tiles shall be heated only from the back.
   m. Do not wash tile for at least 4 days after installation.
   n. Install one quarter of the room at a time for all 12 inch x 12 inch tiles.

2. Installation over Existing Resilient Flooring:
   o. The following existing conditions must be met prior to installation:
      1) Not textured or embossed enough to show through the new installation.
      2) Only a single layer of flooring.
      3) Fully and firmly bonded on an approved subfloor and underlayment.
      4) Waxes, polishes and other finishes must be properly removed with a recommended floor stripper. For existing lin1
      5) Indentations or damaged areas must be replaced or repaired.
   p. Refer to specified manufacturer’s Installation Systems recommendations for additional instructions for installing over each type of existing flooring.

3.06 INSTALLATION OF BASE AND EDGE STRIPS

A. General:

1. Match edges at seams, or double-cut adjoining lengths.

2. Install with tight butt joints.

3. Maintain minimum measurement of 18 inches between joints.

B. Top-Set Base:

1. Install base around perimeter of room or space at base of partitions, columns, pilasters, and other permanent fixtures where scheduled.

2. Unroll base material, and let relax.

3. Cut into accurate lengths as required for minimum number of joints.

4. Apply adhesive, and firmly adhere to wall surfaces.

5. Press down so that bottom cove edge follows floor profile.

6. Corners:
   q. Miter internal corners.
   r. Use premolded corners for external corners.

7. Scribe base accurately to abutting materials.

C. Edge Strips:

1. Apply adhesives, and bond securely to substrates in straight, true lines.

2. Provide where resilient flooring terminates, exposing edge of covering.

3. Center edge strips under doors where resilient flooring terminates at a door opening.

4. Top of strips shall be flush with top of resilient flooring.

5. Install reducer strips where required to provide smooth transition between resilient flooring and other finish.

3.07 FINISHING AND CLEANING

A. Clean approximately 96 hours after installation, or after adhesives have cured and after completion of adjacent work, as recommended by manufacturer for type of flooring installed.

1. Sweep or vacuum floor thoroughly.

2. Clean surfaces with a neutral cleaner.

3. Follow manufacturer's recommended procedure for cleaning and polishing.

4. Remove excess adhesive and other surface blemishes, using appropriate recommended cleaner.

B. Protect flooring against damage and from normal wear and tear during construction period, in accordance with flooring manufacturer's directions, so that flooring will remain without indication of use or damage.

1. Protect flooring by covering with nonstaining building paper.

2. Protect flooring against rolling loads by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.

END OF SECTION

SECTION 096718
EPOXY FLOOR COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Epoxy coating at existing toilet room floors, and other locations as shown on the Drawings.

B. Related Requirements:
   1. Cast-in-Place Concrete: Section 03 30 00.
   2. Tiling: Section 09 30 00.
   3. Acoustic Insulation and Sealants: Section 09 82 00; acoustical sealants and sound control requirements.
   4. Painting and Coating: Section 09 90 00.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 33 00, “Submittal Procedures.”

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer’s literature for coating including application instructions including chart of standard colors.

B. Samples: Selected color, texture, and gloss, not less than 6 inches square, prepared on suitable backing for review by Architect at jobsite.

C. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 INFORMATIONAL SUBMITTALS

A. Quality Assurance: Applicator qualifications and verification that applicator is approved by material manufacturer.

1.05 CLOSEOUT SUBMITTALS

A. Recommended cleaning and maintenance procedures.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in work similar to that required on this Project, with not less than 5 years of documented experience.

B. Mockup: First installed example of each installation condition of epoxy floor coating shall serve as a mockup for review by Architect of workmanship, visual effect, slip resistance, and interface with adjacent construction.

C. Slip Resistance: Walking surfaces shall provide a value equal to or greater than 0.42 when tested in accordance under dry conditions with DCOF AcuTest procedure contained in ANSI A137.1:2012, Section 9.6, and under wet conditions with DCOF AcuTest procedure of ANSI/NFSI B101.0-2012 Walkway Surface Auditing Procedure,. ANSI/NFSI B101.1-2009 and the ANSI/NFSI B101.3-2012 national walkway safety testing standards. Individual tests shall be made for each contiguous area. Test results shall be reported in writing to the Architect.

1.07 FIELD CONDITIONS

A. Protect concrete flat work during curing and subsequent construction activities as required to prevent damage by impact or stains from rubbish and the work of other trades.

B. Storage area and surface of concrete shall be maintained at temperatures required by coating manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURED SYSTEM

A. Basis of Design Manufacturer: Tera-Lite Inc. , 1631 S. 10th Street, San Jose, CA; Telephone 408.288.9655; Website: www.tera-lite.com.

B. Basis of Design Product: “Tera-Gem III CQ and DQ Epoxy Floor” by Tera-Lite; “Everlast Eco Floor”, thin build water-based epoxy floor coating system or equal.

2.02 MATERIALS

A. Epoxy Coating:”Tera-Gem III CQ and DQ Epoxy Floor” a 100 percent solids unpigmented epoxy resin system with no VOC’s and recycled glass aggregate that is a troweled in place, evenly textured, slip-resistant finish of between 1/8 inch and 3/16 inch thickness.
   1. System shall not require primer (unless needed due to the substrate), bond coat, grout or sealer components for application.
   2. System shall comply with the USDA guidelines for use in federally inspected facilities.

B. Glaze: Standard finish – a high performance, chemical resistant, two-component, clear sealer. Tera-Gem III CQ and DQ Floor with 1 coat of Tera-Lite Glaze.

C. Wall Base: A three-component, integral troweled base and cove consisting of Tera-Lite Epoxy Systems Inc’s “Tera-Lite Floor resin and hardner”, recycled glass aggregates as used in the floor, and finely graded calcium carbonate aggregate, 6 inches height or as scheduled.

D. Color as selected by Architect from manufacturers standard color range.

E. Patching products: Epoxy Patch or Concrete Patch as recommended by Tera-Lite.

F. Skid Resistance Additive: Safe Grip product as recommended by Tera-Lite for skid resistance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions.
   1. Inspect all surfaces to receive epoxy flooring. Verify that surfaces are dry, clean, and free of contaminates that would prevent epoxy flooring from properly adhering to the surface.
   2. Conduct calcium chloride testing according to ASTM F1869.
   3. Conduct surface profile inspection according to ICRI Technical Guideline No.03732.
   4. Before starting work, report in writing to the authority having jurisdiction any unsatisfactory conditions.

3.02 SURFACE PREPARATION

A. Prepare surfaces using methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. The substrate shall be clean, dry and sound. Remove dust, laitance, grease, curing compounds, waxes, foreign particles and any previously applied potentially incompatible coatings by scarifying, chipping, wire brushing, acid etching, or pressure washing. Steel shot blasting is not permitted. If pressure washing or any other liquid method is used for preparation, substrate should be fully rinsed, squeeze-dry mopped and allowed to completely dry.

C. Ceramic Tile: Tile and grout shall be thoroughly cleaned. Loose tile shall be removed and filled in with underlayment.

D. Create a light surface profile by mechanically abrading the surface of the tile using a 60-grit sandpaper Sand just enough to remove the gloss, but still fine enough to prevent leaving any marks that may show later through the new epoxy coating.

E. Wipe the tile with a tack cloth to remove the dust.

F. Rout and clean moving cracks and joints: fill with manufacturer’s recommended flexible epoxy filler material.

G. Repair any non-moving surface deviations with manufacturer’s recommended patching material.

H. Pretreat cracks and control joints as required by coating manufacturer.

I. Do not proceed with application of coating until concrete is acceptable.

3.03 INSTALLATION

A. Install coatings in accordance with manufacturer’s instructions, to match accepted samples and mockup.

B. Mix multi-component materials in accordance with manufacturer’s instructions.

C. Use application equipment, tools, and techniques in accordance with manufacturer’s instructions.

D. Apply flooring in accordance with manufacturer's instructions. Apply to a minimum thickness of 1/8 inch. Finish to smooth level surface sloped to drains.

E. Provide base and cove at vertical surfaces.

F. Apply top coat glaze.

G. Key in all drains, edges, and transition points according to manufacturer’s instructions.

H. Broadcast aggregates in accordance with the specified system and manufacturer’s instructions.

I. Adhere to all limitations, instructions, and cautions for epoxy coating as stated in the manufacturer’s published literature.

3.04 FIELD QUALITY CONTROL

A. Verify coatings and other materials are as specified.

B. Verify coverages of the system as work progresses. Areas found not to meet the required thickness shall receive additional material until specified thickness is attained.

C. Manufacturer’s representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.05 PROTECTION AND CLEAN-UP

A. Installation areas must be kept free from traffic and other trades during the application procedure and cure time.

B. Protect finished surfaces of coating system from damage during construction.

C. Touch-up, repair or replace damaged flooring system after substantial completion.

D. Clean area and remove all debris upon completion of work. Dispose of empty containers properly according to current Local, State and Federal regulations.

3.06 MAINTENANCE

A. Contractor shall provide to Owner, maintenance and cleaning instructions for the floor system upon completion of work. Owner is required to clean and maintain the surfaces to maintain manufacturer’s warranty.

END OF SECTION

SECTION 096810
CARPET TILE

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 modular carpet tile.

B. Related Sections include the following:

1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 SUBMITTALS

A. Product Data: For carpet tile, adhesives, and accessory materials.

1. Carpet Tile: For each type indicated, include manufacturer's written data on physical characteristics, durability, fade resistance, and installation recommendations for each type of substrate.

2. Documentation of VOC content for adhesives.

3. Documentation indicating carpet installed in the building interior meets the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

C. Qualification Data: For Installer.

D. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

E. Warranty: Special warranty specified in this Section.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by manufacturer for installation of manufacturer’s products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.7 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sustainability Requirements: Carpet shall comply with 2022 California Green Building Standards Code, Section 5.504.4.4: Carpet installed in the building interior shall meet the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

2.2 CARPET TILE, GENERAL

A. Carpet tile shall meet product and testing requirements of at least one of the following:

1. Testing and product requirements of CRI's "Green Label Plus" program.

2. Carpet and installation adhesives products comply with the testing and product requirements of the California Department of Public Health’ "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. NSF/ANSI 140 at the Gold level or higher.

4. Scientific Certifications Systems Sustainable Choice.

B. Basis of Design: Drawings and Specifications are based on the following:

1. Tarkett, Applause III 02803 – Modular carpet tile.

a. Subject to compliance with requirements, provide product indicated or a comparable product subject to Request for Substitution.

C. Physical Characteristics:
1. Color: Tide 28523.
2. Size: 24 by 24 inches, modular tiles.
3. Construction: Tufted.
4. Face Fiber: Dynex SD Nylon
5. Dye Method: Solution Dyed / Yarn Dyed.
6. Gauge: 1/13.
7. Stitches per Inch: 8.20.
8. Pile Thickness: 0.085 inches.
9. Pile Density: 2,833.

10. Primary Backing: Synthetic Non-Woven.
11. Secondary Backing: Modular ethos® with Omnicoat Technology™.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended or provided by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, pH range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

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

3.2 PREPARATION

A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates to ensure adhesion of flooring products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

a. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

b. Do not abrasively clean concrete substrates have been treated with a topical concrete vapor control barrier; comply with requirements of vapor control barrier manufacturer.

2. Testing Concrete Substrates: Owner will engage a testing agency to perform tests for moisture vapor emission, humidity, and pH per Division 09 Section “Flooring Moisture and pH Testing.” In the absence of Owner testing, perform the following tests:

    a. Testing for pH: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate pH falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9.

    b. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

        1) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture- vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

        2) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

3. Adhesion Testing: Perform tests recommended by floor tile manufacturer.

C. 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 wide or wider and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

D. 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 manufacturer.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, and thresholds,. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. 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.

F. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

B. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.

C. Remove yarns that protrude from carpet tile surface.

D. Vacuum carpet tile using commercial machine with face-beater element.

E. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

F. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 098200
ACOUSTICAL INSULATION AND SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustic batt and blanket insulation.
   2. Acoustic board insulation.
   3. Acoustical sealants and accessories.
   4. Sound isolation requirements.

B. Related Requirements:
   1. Thermal Board and Blanket Insulation: Section 07 21 17.
   2. Joint Sealants: Section 07 92 00.
   3. Non-Structural Metal Framing: Section 09 22 16; resilient hangers and other acoustical accessories.
   4. Gypsum Board: Section 09 29 00.

C. Refer to Section 01 23 00, “Alternates,” for alternates affecting the work of this Section.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 33 00, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications for each type of insulation and sealant.

B. Samples: Each type of pipe isolation system or product.

C. Sustainable Design Submittals: Refer to Section 01 81 13, “Sustainable Design Requirements” for required submittals. Sustainable design submittals are in addition to other required submittals.

A. Comply with Flame Spread Rating and Smoke Density requirements of IBC.

B. Contractor shall be responsible for providing its workers and subcontractors with the requirements specified in this Section and for subcontractors securing submittal data from vendors.

A. Clearly identify manufacturer, contents, brand name, and applicable standard.

B. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

C. Comply with additional requirements specified in Section 01 60 00, "Product Requirements."

PART 2 - PRODUCTS

2.1 ACOUSTICAL BATTS AND BLANKETS

A. Sound-Control Batt: Unfaced, friction fit, preformed slag mineral or glass fiber with thermosetting resin binders, formaldehyde-free, conforming to ASTM C665, Type I; “EcoTouch PINK FIBERGLAS” by Owens-Corning, or accepted equal.
   1. Thicknesses: Full thickness or cavity, unless otherwise shown.
   2. Surface Burning Characteristics: ASTM E84.
      a. Smoke Developed: 50 or less.
      b. Flame Spread: 25 or less.
   3. Combustibility: Pass ASTM E136.

B. Acoustic Blanket (“AWP”): “Insul-Quilt” Studio Blanket by Insul-Quilts, Inc., 833-853-6444 as scheduled, or equal.
   1. Thickness: As shown on the Drawings.

   2. Surface Burning Characteristics: ASTM E84.
      a. Smoke Developed: 25.
      b. Flame Spread: 10.
   3. Facing: As scheduled at each Wall Assembly.

2.2 ADDITIONAL MATERIALS

A. Acoustical Sealants:
   1. Non-Rated Conditions: USG "Sheetrock Acoustical Sealant," Tremco “Acoustical Sealant,” or equal, conforming to ASTM C919.
   2. Fire-Rated Partition Perimeter Conditions: USG "Sheetrock Acoustical Sealant," Jaco “Fire and Draft Sealer,” or equal.

B. Acoustical Tape: Low-density PVC foam; "Norseal" V-730 Series by Norton Performance Plastics Corp. or equal.

C. Pipe Isolation Systems: Coordinate with Divisions 22, “Plumbing,” and 23, “HVAC.”

D. Electrical Box Treatment:

E. Putty Pads: As specified above for outlet box pads.

F. Sealant Backer Rod: Compressible, rod-stock, polyethylene foam; nongassing, polyethylene-jacketed polyurethane foam; butyl-rubber foam; neoprene foam; or other flexible, permanent, durable, nonabsorptive, closed-cell material as recommended for compatibility with sealant by sealant manufacturer.

G. Miscellaneous Fastenings and Accessories: As acceptable to insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas scheduled to receive insulation so as to ensure protection against inclement weather and other hazards and to verify that work of preceding trades is completed.

B. Examine space allocated for insulation for proper depth to receive material.

3.2 INSTALLATION OF ACOUSTICAL INSULATION

A. Install to fill completely all typical and odd spaces in framing where required.

B. Install snugly between framing members. Fit ends snugly between units and against adjacent construction.

C. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations.

D. At doorframes, cut additional strips of insulation, and hand-pack as necessary to fill voids thoroughly.

E. Install glass fiber batt insulation, R=11 minimum, in otherwise uninsulated wall or ceiling cavities containing plumbing pipes.

3.3 SOUND ISOLATION

A. Sound-insulated partitions and floor/ceiling assemblies are indicated on the Drawings.

B. Seal sound-insulated partitions airtight with acoustical sealant, in accordance with ASTM C919 and manufacturer's recommendations. Install acoustical sealant at partitions where indicated on the Drawings.

C. Intersections: Hold gypsum board back a maximum of 1/4 inch from intersecting gypsum board with floor or other surfaces, and apply a bead of acoustical sealant. Caulk void full and airtight with acoustical sealant.

D. Penetrations:

E. Install pipe isolation system wherever a pipe penetrates a stud or framing member.

F. Coordinate sealing with requirements of Section 09 29 00, "Gypsum Board."

G. Where sound-insulated walls are fire rated, follow requirements of Section 07 84 00, "Firestopping."

H. Prior to closing walls, obtain Architect's observation of insulation installation.

END OF SECTION

SECTION 099000
PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Painting and painter's finish on exposed exterior and interior surfaces to complete the finishing of the Work.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 33 00, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 77 00, “Closeout Procedures.”

B. Coordination: Perform painting work in proper sequence with work of other trades so as to avoid damage to finished work.

1.03 ACTION SUBMITTALS

A. Schedule: Proposed manufacturers products grouped by System using same System identification included in these Specifications.

B. Product Data: Manufacturer's technical information for each product scheduled including paint label analysis and application instructions.

C. Color Samples:
   1. Appropriately label and identify each sample, including location and application. Include manufacturer's name, color number, and gloss units.
   2. Each sample shall have stepped finish, clearly showing each coat and build-up of specified finish. Submit separate samples for each required gloss level.
   3. Resubmit samples as requested until sheen, color, and texture are acceptable to the District’s Representative.

D. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of applicator qualifications.

1.05 MAINTENANCE SUBMITTALS

A. At completion of the Work, deliver to District extra stock of paint of each color used in each coating material used in full, tightly sealed, and clearly marked containers.

B. Provide the following quantities:
   1. Field Colors: One 5-gallon container.
   2. Accent Colors: One 1-gallon container.

1.06 QUALITY ASSURANCE

1. Unsuitability of Specified Products: Claims concerning unsuitability of any material specified (or inability satisfactorily to produce the Work) will not be entertained, unless such claim is made, in writing, to Architect before beginning of application.

2. Single-Source Responsibility:
    1. To the maximum extent practicable, select a single manufacturer to provide all materials required by this Section, using additional manufacturers to provide systems not offered by the selected principal manufacturer.
    2. For each individual system:
        1. Provide primer and other undercoat paint produced by same manufacturer as finish coat.
        2. Use thinner within manufacturer's recommended limits.

3. Applicator Qualifications:
    1. Not less than 5 years of documented experience in painting work similar in scope to work of this Project.
    2. Maintain a crew of painters who are fully qualified to satisfy requirements of this Section.
    3. Provide field test reports verifying that floor paint and striping meet specified requirements for slip resistance.

4. Field Samples:
    1. Request review, by the Architect, of first finished area, room, space, or item of each finish type or color scheme required for color, texture, and workmanship.
    2. Except as otherwise specified, finish a 10-foot length of partition and ceiling for each color scheme required, at locations selected by Architect.
    3. Finish a portion of other items as directed by Architect.
    4. Request review by Architect for color, texture, and workmanship.
    5. Modify selected colors, if requested by Architect, to achieve desired effect.
    6. Use accepted surface as the Project standard for each color scheme.
    7. Comply with additional requirements of Section 01 4339, “Mockup Requirements.”

5. Primers:
    1. Provide finish coats that are compatible with prime paints used.
    2. Review other Sections of these Specifications in which prime paints are to be provided in order to ensure compatibility of total coatings system for various substrates.
    3. Upon request, furnish information to other Sections regarding characteristics of finish materials proposed for use.
    4. Provide barrier coats over incompatible primers, or remove and re-prime as required.
    5. Notify Architect, in writing, of any anticipated problems arising from using specified coating systems with substrates primed by other Sections.

1.07 AMBIENT CONDITIONS

A. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original, new, unopened packages and containers bearing the manufacturer's name and label with the following information:
    1. Name or title of material.
    2. Manufacturer's stock number and date of manufacture.

3. Manufacturer's name.
4. Contents by volume for major pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials in tightly covered containers. Maintain containers in a clean condition, free of foreign materials and residue.

C. Store materials at ambient temperature of between 45 degrees F minimum and 90 degrees F maximum, in a well-ventilated area.

D. Ensure that storage area is neat and orderly.

E. Take precautionary measures to prevent fire and health hazards.

F. Comply with additional requirements specified in Section 01 60 00, "Product Requirements."

1.09 FIELD CONDITIONS

A. Ambient Conditions:
1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
2. Do not apply finish in areas where dust is being generated.
3. Provide adequate lighting.

B. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

1.10 WARRANTY

A. Color and Life of Film:
1. At the end of 1 year, colors of surfaces shall have remained free from serious fading. Variations (if any) shall be uniform.
2. Materials shall have their original adherence at end of 1 year. There shall be no evidence of blisters, running, peeling, scaling, chalking, streaks, or stains at end of this period.

1.11 GUARANTEE

A. Color and Life of Film:
1. At the end of 1 year, colors of surfaces shall have remained free from serious fading. Variations (if any) shall be uniform.
2. Materials shall have their original adherence at end of 1 year. There shall be no evidence of blisters, running, peeling, scaling, chalking, streaks, or stains at end of this period.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Single-Source Responsibility:

1. To the maximum extent practicable, select a single manufacturer to provide all materials required by this Section, using additional manufacturers to provide systems not offered by the selected principal manufacturer.
2. For each individual system:
    a. Provide primer and other undercoat paint produced by same manufacturer as finish coat.
    b. Use thinner within manufacturer's recommended limits.

B. If more than one quality level of product type is marketed, use material of highest quality.

C. Primers:
1. Provide finish coats that are compatible with prime paints used.
2. Provide barrier coats over incompatible primers, or remove and re-prime as required.

D. Deliver paints and stains ready mixed to jobsite. Finish coats shall be smooth and free from brush marks, streaks, laps or pileup of paints, and skipped or missed areas.

E. Edges of paint adjoining other materials or colors shall be clean and sharp with no overlapping.

F. Top and bottom edges of doors shall receive same paint system finish required for door faces.

G. Do not paint over fire-rating labels, fusible links, or sprinkler heads.

H. For field-applied coatings, adjust natural finishes as necessary to obtain identical appearance on veneers and solid stock.
1. Items without factory finish such as conduits, pipes, access panels, and items of similar nature shall be finished to match adjacent wall and ceiling surfaces, unless otherwise directed.

2.02 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: PPG Glidden Professional, Benjamin Moore, Sherwin-Williams, Kelly Moore, Dunn-Edwards, Vista, or equal.

2.03 COLORS

A. As selected by the Architect. Prepare a color schedule with samples for review and approval by the District’s Representative.

2.04 MIXING AND TINTING

A. Deliver paints and stains ready mixed to jobsite.

B. Accomplish job mixing and job tinting only if required for adjustment to finish applied to field test areas to achieve approved color.

PART 3 - EXECUTION

3.01 PREPARATION

A. General: Protect hardware, nameplates, switch plates, lighting fixtures, stainless steel, aluminum, and other surfaces that are not to be painted by masking, by removal, or by other means to ensure a neat job.

B. Wood - General:
   1. Cleaning and Sanding:
      a. Remove handling marks and effects of exposure to moisture with a thorough, final sanding over all exposed surfaces, using 150-grit or finer sandpaper.
      b. Clean and vacuum before applying sealer or finish.
      c. Do not sand resawn surfaces.
   2. Wood to Receive Opaque Finish: Fill nail holes, cracks, open joints, and other defects with filler after priming coat has dried. Color shall match finish color.
   3. Wood to Receive Transparent Finish:
      a. Remove any material that would adversely affect penetration or appearance of finish.
      b. Do not seal wood surfaces to receive transparent finish.

C. Gypsum board shall be prepared and finished for painting as specified in Section 09 29 00, "Gypsum Board."

D. Metals:
   1. Remove mill scale, rust, and corrosion.
   2. Clean oils, grease, and dust from surfaces.
   3. Soluble Salts: Removal of soluble salts from bare metal and galvanized metal surfaces, both interior and exterior, is required prior to application of primer coats to preclude premature coating failure and accelerated corrosion.
      a. Removal shall be in accordance with SSPC-Guide 15, “Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.”
      b. Abrasive blasting, where specified as a required surface preparation procedure, shall be performed after removal of soluble salts. Abrasive blasting is not an acceptable procedure for removal of soluble salts.

E. Ductwork: Clean visible galvanized portion of ductwork interiors with solvent, and wipe clean.

F. Replace unsatisfactory work caused by improper or defective surfaces.

3.02 FACTORY FINISHING AND PRIMING

A. Review all Sections for products that are to be factory finished or factory (shop) primed.

B. Touch-up: Touch up abrasions in prime coat for products after arriving on jobsite and prior to application of finish coats.

3.03 APPLICATION

A. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

B. Shop-fabricated and finished metal and millwork items shall be shop spray finished to the greatest extent possible.

C. Application:
   1. Apply paint with suitable brushes, rollers, or spraying equipment.
   2. Hollow metal doors and doorframes, and other exposed metal requiring field finish painting, shall be sprayed to the fullest extent conditions will permit. If brush or roller application is used, surface finish shall be subject to review by the District’s Representative for complying with the appearance requirements specified herein.
   3. Apply coatings in accordance with manufacturer's recommendations.

4. Rate of application shall be within limits recommended by paint manufacturer for respective substrate.

D. Spray-Gun Application - Standard Coatings:
   1. Spray-apply standard paints only with airless sprayer.
   2. When necessary, follow by brushing to ensure uniform coverage and to eliminate wrinkling, blistering, and air holes.
   3. Comply with recommendation of product manufacturer for drying time between succeeding coats.

E. Refinish whole area where portion of finish is not acceptable.

F. Paint visible surfaces behind vents, registers, or grilles flat black.

3.04 CLEANING

A. Touch up and restore finish where damaged.

B. Remove spilled, splashed, or spattered paint from surfaces.

C. Do not mar surface finish of item being cleaned.

3.05 PAINT SYSTEMS

A. General:
   1. Only major areas are scheduled, but miscellaneous and similar items and areas within room or space shall be treated with suitable system.
   2. This Specification shall serve as guide and is meant to establish procedure and quality. Confer with the District's Representative to determine exact finish desired.
   3. Number of coats scheduled is minimum. Additional coats shall be applied at no additional cost as required to hide base material completely, produce uniform color, and provide required and satisfactory finish.

B. Surfaces Not to Be Painted:
   1. Prefinished wall, ceiling, and floor coverings.
   2. Items with factory-applied final finish.
   3. Concealed ducts, pipes, and conduit.
   4. Surfaces specifically scheduled or noted on the Drawings as not to be painted.

C. Acceptance of Final Colors: Final coat of paint for both exterior and interior shall not be applied until colors have been accepted by the District's Representative.

D. Gloss and Sheen Ratings: Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following limits in conformance with Master Painters Institute, Inc. (MPI) Standards according to ASTM D523. Not all of the Gloss Levels are necessarily scheduled or used on this Project.
   1. Gloss Level 1: Matte or Flat; not more than 5 units at 60 degrees and 10 units at 85 degrees.
   2. Gloss Level 2: Velvet or Low Sheen; not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
   3. Gloss Level 3: Eggshell; 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
   4. Gloss Level 4: Satin; 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
   5. Gloss Level 5: Semi-gloss; 35 to 70 units at 60 degrees.

E. Clarification of System Terminology:
1. Interior paint Systems are specified and identified herein by initial letters "INT."
2. Exterior paint Systems are specified and identified herein by initial letters "EXT."
3. Initial numbers for each System identify the substrate to be coated.
4. Initial numbers for each System identify the substrate to be coated summarized as follows with further clarification included with the System description:

CODE	DESCRIPTION
5	Metal
6	Wood
9	Gypsum Board

5. Letter following substrate numbers identify the general finish coat chemistry summarized as follows:

CODE	DESCRIPTION
A	Standard acrylic
F	Epoxy
H	Aliphatic Polyurethane
M	High dispersion acrylic polymer
S	Semi-Transparent Preservative Stain

6. Hyphenated suffix identifies the topcoat gloss levels.

F. Interior Painting Systems:

INT 3.1A-1
Standard Performance Latex on Concrete - Gloss Level 1

1 coat	Acrylic Primer-Sealer
1 coat	Vinyl Acrylic Flat

EXT 5.3A-5
Acrylic on Shop Primed and Previously Painted Metal - Gloss Level 5

2 coats	100% Acrylic Semi-gloss

Note: Modify gloss level to match approved sample

INT 5.1A-5
Standard Performance Acrylic on Shop-Primed Metal - Gloss Level 5

2 coats	100% Acrylic Semi-Gloss

INT 5.2A-5
Standard Performance Acrylic Latex on Galvanized Metal - Gloss Level 5

1 coat	DTM Metal Primer-Red
2 coats	100% Acrylic Semi-Gloss

INT 5.3M-3
Premium Performance Acrylic on Decorative Metal – Gloss Level 5
Surface Preparation and Shop PrimerAs specified in respective metal Section in Division 05.

1 coat	High dispersion pure acrylic polymer applied 2.0 to 3.0 mils DFT

Note: Provide additional topcoat if required to achieve complete hiding.
Modify scheduled topcoat if other than specified gloss level is selected by Architect.

INT 6.3D-1
Transparent Finish on Base and Trim - Gloss Level 1 (Flat/Matte):

2 coats	As selected by Design-Builder

INT 6.3A-5
Standard Performance Acrylic on Dressed Lumber - Gloss Level 5

1 coat	Acrylic Primer
2 coats	Latex Semi-Gloss

INT 9.2A-1
Standard Performance Acrylic on Gypsum Board - Gloss Level 1

1 coat	Acrylic Primer
2 coats	100% Acrylic Flat

INT 9.2A-3
Standard Performance Acrylic on Gypsum Board - Gloss Level 3

1 coat	Acrylic Primer
2 coats	100% Acrylic Eggshell

INT 9.2A-5
Standard Performance Acrylic on Gypsum Board - Gloss Level 5

1 coat	Acrylic Primer
2 coats	100% Acrylic Semi-Gloss

INT 9.2F-5
Waterborne Epoxy-Modified Latex on Gypsum Board - Gloss Level 5

1 coat	Primer/sealer tinted to finish color
1 coat	Waterborne Semi-gloss Epoxy Polyamide

G. Exterior Painting Systems:

EXT 5.3A-5
Acrylic on Shop Primed Hollow Metal Doors and Frames - Gloss Level 5

2 coats	Acrylic Semi-gloss

EXT 5.3H-5
High-Performance Aliphatic Polyurethane on Galvanized Decorative Metal - Gloss Level 5

1 coat	Two-component, VOC compliant, water-based epoxy tinted to match color of topcoat (if primer not shop applied)
2 coats	VOC compliant polyester-acrylic aliphatic polyurethane

Note: Provide additional topcoat if required to achieve manufacturer's recommended total DFT (primer plus finish coats), or to achieve complete hiding for selected color.

EXT 6.3S-1
Semi-Transparent Finish on Wood Siding - Gloss Level 1 (Flat/Matte):

1-coat	"LifeTime" Wood Treatment"	Non-toxic wood stain by Valhalla Wood Preservatives Ltd.

System components as required to match approved sample.

END OF SECTION

SECTION 099623
GRAFFITI-RESISTANT COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Liquid-applied sacrificial surface sealer for all exterior concrete wall surfaces that will prevent penetration of staining mediums and allow easy removal and reapplication.

B. Related Requirements:
   1. Section 03 30 00 – Cast-in-Place Concrete.
   2. Section 09 90 00 – Painting and Coating.
   3. Section 32 32 15 – Landscape Concrete.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Section 01 33 00 - Submittal Procedures.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications, installation instructions, and general recommendations for specified coating materials. Include instructions and recommendations for cleaning and preparation of concrete surfaces, coating and recoating application techniques, equipment to be used, coverage rates, accessory materials, and special removal procedures.

B. Samples: 12-inch-square of each substrate to receive graffiti-resistant coating, with coating applied to half of each sample.

1.04 INFORMATIONAL SUBMITTALS

A. Statement of applicator qualifications.

B. Letter documenting work has been applied in compliance with specifications and manufacturer's written instructions and that specified field testing has been satisfactory.

1.05 CLOSEOUT SUBMITTALS

A. Extended warranty.

B. Maintenance materials.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Approved in writing by the manufacturer with documented experience in application of similar graffiti-resistant coatings.

B. Mockup:
   1. Treat and evaluate a minimum eight square foot area of completed wall at the Project site for product adhesion, compatibility and appearance.

2. Apply and remove graffiti to a portion of the mock-up to the satisfaction of the Owner's Representative.
3. Application shall not continue unless mockup is acceptable to Owner's Representative.

C. Do not apply specified coatings when surfaces or ambient air temperature is below 45 degree F or over 90 degrees F, or expected to drop below freezing during the 24-hour period following application.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials at site in protected location, and away from flame, excessive heat, at temperatures above 40 degrees F.

1.08 MAINTENANCE

A. At completion of the Work, deliver to Owner specified cleaning and application solution sufficient to clean and recoat a minimum of 500 square feet of coated wall surface.

B. Stock shall be in factory sealed and clearly labeled containers.

C. Stock shall be delivered and stored as directed by the Owner.

1.09 WARRANTY

A. Manufacturer: Provide Owner with a written 10-year warranty, signed by the manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship. Defects are defined to include failure to withstand complete graffiti removal, ghosting, shadowing, chemical stain, yellowing, and normal environmental effects.

PART 2 - PRODUCTS

2.01 PERFORMANCE CRITERIA

A. The coating shall not darken, stain, or discolor substrate surfaces.

B. The coating shall be non-yellowing.

2.02 MATERIALS

A. Graffiti-Resistant Coating System: "Defacer Eraser" SC-1 by Prosoco, or equal meeting governing VOC requirements.

B. Application Equipment: Medium-to-large-capacity airless sprayer and hoses or other equipment as recommended by the coating manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are dry, clean, and free of dust, dirt, grime, oils, alkali or acid residues, and other contaminants or compounds unacceptable to the graffiti-resistant coating manufacturer.

3.02 PREPARATION

A. Clean and prepare substrates in accordance with graffiti-resistant coating manufacturer's instructions.

B. Test for moisture content in accordance with manufacturer's instructions to ensure that surface is sufficiently dry.

C. Protect adjacent surfaces not to receive coating from spillage or blow-over.

D. Cover adjoining and nearby surfaces of metal and glass as required.

3.03 APPLICATION

A. Apply graffiti-resistant coating following manufacturer's recommendations for number of coats and their application.

B. Avoid runs or applying coating to heavily as this will impair transparency of cured material. Excessive coating will turn milky when it gets wet after curing.

C. Runs or sags on masonry surface shall be immediately brushed out using a clean soft brush.

D. Clean spillage from horizontal surfaces immediately after spillage.

END OF SECTION

SECTION 101100
VISUAL DISPLAY BOARDS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:.
   1. Porcelain enamel markerboards.
   2. Fabric-Wrapped tackboards.
   3. Hardware and accessories for complete installation.

B. Related Requirements:
   1. Architectural Wood Casework; Section 06 41 00; casework.
   2. Gypsum Board: Section 09 29 00; gypsum substrate.
   3. Painting and Coating: Section 09 90 00; Preparation and priming of substrate.

1.02 REFERENCES

A. Tack Board Wall Covering; Compliace with CBC 803.1 for flame spread and smoke development classification.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Dimensioned elevations, sections, and details.

B. Product Data: Manufacturer's technical data and installation instructions.

C. Samples:
   1. Boards: 5 by 8 inches, full thickness, illustrating each color and finish.
   2. Trim: Each profile, minimum 8 inches long.

D. Sustainable Design
   1. Submit information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturer's certification that materials furnished comply with specified requirements.

1.05 CLOSEOUT SUBMITTALS

A. Manufacturer's cleaning and maintenance instructions covering both routine (daily or weekly) and long-term (yearly or longer) operations.

B. Extended warranty.

1.06 WARRANTY

A. Porcelain-Enamel Markerboards: Furnish manufacturer's 20-year written warranty

agreeing to replace boards that do not retain their original writing and erasing qualities, that become slick and shiny, or that exhibit crazing, cracking, or flaking, provided manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design: Compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

B. Requirements of Regulatory Agencies: Chalkboards and tack boards shall conform to California Code of Regulations, Title 19, Article 42.
   1. Size: To provide areas indicated in interior elevations with minimum vertical joints.
   2. Utilize concealed mounting system.
   3. Provide as magnetic system, color to be as selected by Architect from manufacturers standard CBC selections.

2.02 PORCELAIN MARKER BOARDS

A. Porcelain on Metal: Balanced, high-pressure-laminated, 3-ply construction with facing sheet, core, and backing; meeting the following requirements; Claridge “LCS” 800 Series as specified, or equal.

B. Provide full width chalk tray with ends filed smooth; display rail with cork inserts, end stops and two hook/clips per board; one set of 4 pens and eraser for each.

C. Provide trim as shown at jambs.

D. At top and bottom edges provide #507-2 mounting angle clips at 24 inches on center, or at studs, and #16A spotting adhesives behind all boards.

2.03 TACK BOARDS

A. Fabric-Wrapped Tack Boards: With fabric over cork and aluminum frames; Koroseal Tac-Wall Series as specified; Claridge 800 Series, or equal, 24-26 pcf density, with a Class A fire rating, 1/2-inch thick, with exposed faces and edges adhered and completely wrapped in fabric.
   1. Surface shall be wrinkle free with tailored edges.
   2. Fabric: As scheduled on the Drawings.
   3. Panel Edge: Square.
   4. Panel Fasteners: as recommended by Koroseal.
   5. Size: To fit casework locations shown on Drawings.

   6. At top and bottom edges provide #507-2 mounting angle clips at 24 inches on center, or at studs, and #16A spotting adhesives behind all boards.
   7. Size as indicated.

2.04 ALUMINUM TRIM AND ACCESSORIES

A. Aluminum Trim: Slip-on type; 6063-T5 alloy extrusions of at least 0.062 inch wall

thickness.
1. Finish: Clear anodized, AA designation M12C22A31.
2. Provide trim in single lengths wherever possible, otherwise keep joints to a minimum.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install visual display boards plumb and level and in conformance with requirements of NAAWS Standard and as shown.

B. Damaged, stained, scratched, or otherwise disfigured portions of the work shall be touched up, refinished, or replaced to satisfaction of the District's Architect.

END OF SECTION

SECTION 101400
SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Room and door signs
   2. Building, wayfinding, and title signs
   3. Dimensional sign characters and logos

1.02 ACTION SUBMITTALS

A. Shop Drawings: Full-scale drawings for each sign indicating materials, lettering layout, and colors.

B. Product Data: Manufacturer's specifications, recommendations, and installation instructions for each sign Type including installation templates and attachment devices.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. Request content of signs from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Building signage, including, but not limited to, directional/ wayfinding signs, plaques, graphic elements and marquee signs:
   1. ALL signage shall be submitted for approval by the Owner for content, color, size and other physical qualities.
   2. ALL signage shall not be fabricated or installed without the written approval of the Owner.

E. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

F. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

G. Verification Samples: Submit samples showing colors specified.

H. Sustainable Design:
   1. Submit information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000 - Product Requirements.
B. Package signs as required to prevent damage before installation.

C. Package room and door signs in sequential order of installation, labeled by floor or building.
D. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

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

1.06 WARRANTY

A. See Division 01 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a one-year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Signage shall conform to the following:
   1. ANSI A-117.1 and the Americans with Disabilities Act (ADA).
   2. ATBCB Design Guidelines for Signage in relation to the Americans with Disabilities Act.
   3. California Code of Regulations, Titles 19 and 24.
   4. Signage shall conform to 2022 CBC Sections 1003, 1013, and 11B-703 and the Authorities Having Jurisdiction.
   5. Uniform Sign Code.
   6. The event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Grade 2 Braille shall be used whenever Braille symbols are specifically required. Refer to CBC Section 11B-703

C. Signage application:

   1. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
      a. Sign Type: Flat signs with extruded acrylic panel media as specified.
      b. Provide "tactile" signage, with Grade 2 Braille.
      c. All letters, numbers and/or symbols shall contrast with their background. Characters and background shall have a non-glare finish.
      d. Background color as selected by Architect from manufacturer’s actual color samples.
      e. Letterform, size as selected by Architect in upper case letters and numbers.
      f. Provide solid cover plate for back side of sign where mounted to glass.

   2. Exterior Room Identification Signage
      a. Provide cast aluminum sign with raised letters and border.
      b. Raised letters and border shall be satin finish with painted background.
      c. Signs shall have room function followed by Grade 2 Braille directly below.
      d. Provide at all exterior mechanical, electrical, fire riser rooms or other exterior locations.
      e. Entry/Exit Numbering shall start at main primary entry and continue sequence in clockwise direction around the building.

   3. Code Required Signage: Fire Protection and Utility Equipment Identification Access and Emergency Signage. See “Schedules” article below.

4. Building, Wayfinding and Title Signs:
    a. Fabricated Box Letters: Laser cut using computer-guided equipment.
        1) Material: Aluminum
        2) Letter Height and Depth: Reference drawings.
        3) Letter Construction: Fabricated Aluminum faces are produced with .090” aluminum.
        4) Returns are produced with .063” aluminum.
        5) Letterstyle: Fabricated Aluminum Letter. Letters shall be Arial for bidding purposes. Reference drawings and verify actual font with Owner prior to fabrication.
        6) Finish: Powder coated aluminum or clear anodized finish as selected from manufacturer’s full range.
        7) Mounting:
            a) Bottom Stud Mount. Letters shall be vertically cantilevered off of their support. Angled "tie-backs" are not acceptable.
            b) Wall Mount: Per sign manufactuer/installer’s recommendations. Reference drawings to ensure penetrations through building exterior envelope remain watertight.
    b. All exterior wall, roof, and structure mounted letters/signs to be engineered by the sign manufacturer for mounting requirements and structural connections in accordance with the applicable wind loading and building codes to be reviewed and approved by the Architect’s structural engineer. Sign manufacturer shall coordinate with adjacent building trades for connection requirements prior to other building elements being installed.

D. Dimensional sign characters and logos:

1. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.

    a. Character Material: Aluminum.
    b. Character Finish: Clear anodized.
    c. Character Height: As indicated on Drawings.
    d. Text Style: As selected by Architect from manufacturer’s standard font styles.
    e. Text/Message: As indicated on Drawings.
    f. Mounting: Projecting studs and/or bottom mounted studs (noncorroding for substrates encountered), as indicated on the Drawings and in the Signage Schedule.

2.02 MATERIALS AND COMPONENTS

A. General: Materials listed below are not necessarily all-inclusive, nor are all materials listed necessarily required to be used based on final designs and layouts provided by the Architect.

B. Acrylic Sheet: ASTM D702, Type III.

C. Phenolic-backed melamine plastic laminate faced sheet, 0.25-inch thick.

D. Fiberglass Sheet, 0.25-inch thick

E. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

1. Finishes:
    a. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a nonspecular as fabricated mechanical finish, complying with AAMA 611.

F. Stainless Steel:

1. Provide stainless-steel plate, sheet, and strip, Type 302 or Type 304, complying with ASTM A666.

2. Steel Sheet: Commercial-quality, cold-rolled, stretcher-leveled, carbon-steel sheet complying with ASTM A366, Class I, matte finish, galvanized.

3. Finishes:

    a. Remove tool and die marks and stretch lines or blend into finish. 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. Appearance: Bright, directional polish, No. 4 finish.

G. Anchors and Inserts: Temper resistant fasteners, fabricated from nonferrous metal or hot-dipped galvanized anchors and inserts as required for corrosion resistance between dissimilar metals.

H. Silk-Screen Ink: Opaque enamel; Series 1100 “Sty-Ra-Lac,” by Naz-Dar, Matthews Screen “MAP,” or equal. Screen materials and methods to be in accordance with manufacturer’s specifications.

I. Adhesive: Double sided tape and clear silicon adhesive or as recommended by sign manufacturer.

1. VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 METAL FINISHES

A. General:
3. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
4. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
5. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

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

1. Examine work area with installer present.
2. If existing conditions are not as required to properly complete the work of this section, notify Architect.
3. Do not proceed with installation until deficiencies in existing conditions have been corrected.

B. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 INSTALLATION

A. General:
1. Signage shall be mechanically fastened.
2. Install signs level and plumb with sign surfaces free from distortion or other defects in appearance.
3. Locate specific mounting heights in coordination with the current ADA regulations.
4. Coordinate final locations with the Architect.
   a. If no location is indicated, obtain Owner’s instructions prior to installation.

B. Applied Copy Signs and Graphics:
1. Apply signage and graphics centered and level, in line, in accordance with manufacturer's recommendations.
2. Job site applied vinyl graphics shall be applied and pre-spaced on application tape prior to installation.

C. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

2.05 FIELD QUALITY CONTROL

B. In addition to review by the Architect, contractor shall arrange to have signs field inspected after installation in accordance with CBC 11B-703.1.1.2 Inspection.

C. Damaged signs shall be repaired to the satisfaction of the Architect or shall be replaced.

2.06 SIGNAGE SCHEDULE

B. To be provided by the Architect.

END OF SECTION

SECTION 102113
REINFORCED COMPOSITE TOILET COMPARTMENTS

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 solid-polymer plastic toilet compartments configured as toilet enclosures and urinal screens; floor anchored and overhead braced.

B. Related Sections:

1. Division 09 Section “Non-Structural Metal Framing” for backing and blocking for supports for toilet compartments.
2. Division 10 Section “Toilet Room Accessories” for toilet tissue dispensers, seat cover dispensers, grab bars, and similar accessories.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment material indicated.

D. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate requirements for blocking and reinforcement for wall anchorage of toilet compartments and urinal screens with wall framing.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Accessible Regulatory Requirements: Toilet compartments and urinal screens designated as being accessible to persons using wheelchairs shall comply with applicable provisions of the 2010 ADA Standards for Accessible Design, ICC/ANSI A117.1, and the 2022 California Building Code with latest Supplement(s).

B. Wheelchair accessible toilet compartments shall have minimum clear dimensions as follows:

1. Compartment Width: 60 inches.
2. Compartment Length: As required to provide the following clear spaces and/or clearances:

a. Clear Space from Rear Wall: Clear space measured from the rear wall; clear space shall include the water closet, no doors may swing into this clear space:

1) Wall Mounted Water Closets: 56 inches.
2) Floor Mounted Water Closets: 59 inches.
3) Children’s Compartments: 59 inches for wall mounted and floor mounted water closets.

b. Maneuvering space in front of water closets:

1) End opening stalls: 48 inches.
2) Side opening stalls: 60 inches.

c. Additional clearance as may be required for door pull side strike edge clearance.

3. Door Widths: Clear widths as follows:

1) End opening stalls: 32 inches.
2) Side opening stall: 34 inches.

4. Door Maneuvering Clearances, Location, and Hardware:

    a. Pull Side Clearances:

        1) Pull side strike edge clearance: 18 inches measured from the strike edge of the door in a closed position.
        2) Pull Side Clearance Perpendicular to Door: 60 inches from the door in a closed position.

    b. Push Side Clearance Perpendicular to Door: 48 inches from the face of the door in a closed position.
    c. Maximum distance from edge of door opening to adjacent intersecting wall or partition panel: 4 inches.
    d. Doors located at end opening stalls shall be located in front of the open space adjacent to the side of the water closet.
    e. Door Operating Hardware:

        1) Doors shall be self-closing (gravity hinge).
        2) An accessible pull shall be located on each side of the door near the latch.
        3) Operating hardware and pulls shall be located between 34 and 44 inches above the floor.
        4) Operable hardware shall be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. The force to operate hardware shall not exceed a 5 pound force.

5. Toe Clearance: Partitions shall have toe clearance of 12 inches minimum measured from the floor to the bottom of partition panels, exclusive of support members.
6. Width of Accessible Route to Compartments: 44 inches.

C. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets totals 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.

1. 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.

D. Screens at Wheelchair Accessible Urinals: 36 inches minimum clear width.

2.2 SOLID POLYMER TOILET COMPARTMENTS AND SCREENS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Accurate Partitions Corporation.
2. General Partitions Mfg. Corp.
3. Scranton Products (Capitol/Comtec/Santana).

B. Toilet Enclosure Style: Floor anchored, overhead braced.

C. Urinal Screen Style: Wall supported at one end with a pilaster and overhead bracing or post at the opposite end.

D. Doors, Panels, and Pilasters: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.
2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-polymer doors and panels to prevent burning.
3. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

E. Pilaster Shoes: Manufacturer's standard design; stainless steel, 3-inches high.

F. Wall Brackets for Compartments: Manufacturer's continuous full height aluminum with bright dipped anodized finish wall brackets.

1. Profile: Double-ear profile unless single-ear, U-shaped or H-shaped profile is required for project conditions.

G. Wall Brackets for Compartments: Manufacturer's continuous full height polymer wall brackets.

1. Profile: Double-ear profile unless single-ear, U-shaped or H-shaped profile is required for project conditions.

H. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in bright dipped anodized finish.

1. Wall Brackets for Headrails: 16 gage stainless steel.
2. End caps for Headrails: Manufacturer’s standard aluminum caps.

I. Floor Supports: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

J. Fasteners: All fasteners shall be stainless steel. Exposed fasteners shall have theft-resistant-type heads. Provide sex-type bolts for through-bolt applications.

1. Fasteners for Floor and Wall Connections:
   a. Metal Stud Framed Walls: No. 14 self-tapping sheet metal screw by length required to penetrate 1-inch beyond metal framing.
   b. Concrete or Masonry Floors and Walls: Self-threading type masonry screws installed into pre-drilled holes, Hilti Kwik-Con II or equivalent, 1/4-inch diameter by 2-3/4 inches long with Torx hex washer head, stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories as follows:

1. Hinges: Heavy duty extruded aluminum hinges, 8-inches in length, with wrap-around flanges, through bolted to pilasters and door panels with sex bolts. Hinges shall be self-closing type (gravity hinge) that can be adjusted to hold doors open at any angle up to 90 degrees.
2. Latch and Keeper: Surface-mounted heavy duty extruded aluminum latch and keeper unit designed for emergency access and with combination rubber-faced door strike and keeper secured to doors and panels with sex bolts. Strikes shall be a minimum of 6-inches long. Slide bolts shall have a black anodized finish.

    a. Accessible Stalls: Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to persons with disabilities. Latches shall be flip-over style, sliding, or other hardware not requiring the user to grasp or twist.

3. Door Bumpers and Coat Hooks:

    a. In-Swinging Doors: Manufacturer's standard chrome plated Zamac rubber-tipped combination coat hook and bumper, sized to prevent door from hitting compartment-mounted accessories, wall, or partition; 4 inch maximum projection; provide one at each in swinging door.
    b. Out-Swinging Doors: Coat hook only, 1-1/2 inch maximum projection, mount at 46 inches maximum above the floor on the stall side of the door; Bobrick B-233 or equivalent.

4. Door Pulls: Manufacturer's standard chrome plated Zamac door pulls, provide door pulls on the pull side of compartment doors.

    a. Accessible Stalls and Ambulatory Accessible Stalls: Provide an accessible door pull on each side of doors near the latch at compartments indicated to be accessible to persons with disabilities. Door pulls shall be loop or U-shape complying with accessibility requirements of authorities having jurisdiction.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

C. Material Finishes, General: Provide hardware and accessories having the finishes indicated for the following materials:

1. Aluminum: Bright dipped anodized aluminum.
2. Stainless Steel: Satin finish.
3. Zamac: Chrome-plated, nonferrous, cast zinc alloy (zamac).

    a. Zamac shall only be allowed for pulls, door bumpers, and combination coat hook/door bumpers.

2.4 FABRICATION

A. General: Provide panels of sizes indicated and as required for project conditions. Machine edges to have radius of 1/4-inch. Exposed panel surfaces shall be free of saw marks, cuts, nicks or other damage.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door and Panel Heights: Doors and panels shall be fabricated in 55-inch heights (Bottom of panel to top of panel).

D. Pilaster Heights: 82-inches.

E. Urinal Screens: Urinal screens shall be fabricated in 50-inch panel heights by 21-inches in depth.

F. Continuous Wall Brackets: Continuous wall brackets shall be cut to lengths one-inch less than panel heights.

G. Door Size and Swing: Unless otherwise indicated, provide doors as follows:

1. Standard, Non-Accessible Stalls: 24-inch wide in-swinging doors.
2. Wheelchair Accessible Stalls: 36-inch wide doors with a minimum 34-inch wide clear opening; doors shall be in-swinging or out-swinging as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.
2. Accurately measure toilet rooms receiving compartments and locations of fixtures.

B. Proceed with installation only after unsatisfactory conditions have been corrected; commencement of work constitutes acceptance of conditions.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices in compliance with the specifications.

1. Maximum Clearances:

    a. Pilasters to Panels: 1/4 inch.
    b. Panels to Walls: 1 inch.

2. Comply with referenced regulatory requirements for compartments and screens to be installed at water closets and urinals indicated to be accessible.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than two fasteners. Head rails shall be cross braced with intersecting head rails spaced not more than 6 feet on center and aligned with the panels below. Install doors and panels with top edges level and aligned, adjust doors so tops of doors are parallel with overhead bracing when doors are in a closed position. Doors, panels and screens shall be installed with the bottom edge approximately 14-inches above the floor (approximate dimension for accommodation of floor slope).

C. Urinal Screens: Attach screens to wall with continuous wall bracket at one end and to pilaster or post support at opposite end. Set units level and plumb and to resist lateral impact.

1. Mounting height and wall projection of urinal screens shall comply with 2022 CBC Section 1210.3.2.

    a. Bottom of Screen from Floor: 12 inches maximum.
    b. Top of Screen from Floor: 60 inches minimum.

    c. Projection from Wall: 20 inches minimum and not less than 6 inches minimum beyond the outermost lip of the urinal.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges to return doors to a fully closed position unless otherwise noted.

END OF SECTION

SECTION 102238
OPERABLE PANEL PARTITIONS

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. Manually operated, acoustical paired panel partitions.

B. Related Requirements:
1. Division 05 Sections “Structural Steel Framing” and "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.

1.3 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, details, numbered panel installation sequence, and attachments to other work.

2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, facing, or accessory involving color selection.

D. Delegated-Design Submittal: For operable panel partitions.

1. Include design calculations for seismic restraints.

E. Qualification Data: For qualified Installer.

F. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:

1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.

2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.

G. Product Certificates: For each type of operable panel partition.

H. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

I. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.

b. Seals, hardware, track, track switches, carriers, and other operating components.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark

packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.9 COORDINATION

A. Coordinate floor flatness and levelness requirements for operable panel partitions with Work for concrete slabs-on-grade specified in Division 03 Section “Cast-in-Place Concrete.’

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified civil or structural engineer licensed in the State of California to design seismic bracing of tracks to structure above.

B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the California Building Code.

1. The term "withstand" means "the partition panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."

C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; 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.

2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 MANUFACTURERS

A. Basis-of-Design Manufacturer: In other Part 2 Articles where named manufacturer's products are indicated, Drawings and Specifications are based on products manufactured by the following:

1. Modernfold, Inc.; a DORMA Group company.

a. Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

1) Advanced Equipment Corporation.
2) Hufcor, Inc.
3) Panelfold Inc.

2.3 OPERABLE PANEL PARTITIONS

A. Basis-of-Design Product: Drawings and Specifications are based on the following:

1. Modernfold, Inc.; a DORMA Group company; Acousti-Seal Premier – Paired Panel (932): Manually operated paired panel operable partition.

B. General Description: Manually operated, top supported with operable floor seals, paired panel operable partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. STC: Not less than 45.

C. Panels: Panel construction as required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

1. Panel Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

    a. Panel Width: Manufacturer’s standard widths, 48 inches nominal.
    b. Panel Thickness: Manufacturer’s standard thickness, 3 inches nominal.

2. Panel Weight: 8 lb/sq. ft. maximum.

3. Panel Materials:

    a. Frame: Steel sheet, manufacturer's standard, 0.0508-inch (18 gauge) nominal minimum thickness for uncoated steel.
    b. Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard 0.0299- inch minimum nominal thickness for uncoated steel.

4. Panel Closure: Manufacturer's standard unless otherwise indicated.

5. Panel Edges (Trimless): Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

D. Panel Finish Facings: Provide finish facings for panels that comply with indicated fire-test- response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

1. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.

    a. Total Weight: 15 ounces per lineal yard (10 ounces per square yard).
    b. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
    c. Color/Pattern: As selected by Architect from manufacturer's full range.
    d. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.

E. Seals, General: Provide seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.

2. Seals made from materials and in profiles that minimize sound leakage.

3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

4. Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous PVC acoustical seal.
5. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.
6. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
    a. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by manually operating self contained handle.
    b. Operating clearance of 2 inches and operating range of plus 1/2 inch and minus 1- 1/2 inches between seal and floor finish.

F. Suspension System:

1. Tracks: Steel track with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
    b. Basis of Design: Modernfold; No. 14 track system.

2. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.

3. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

4. Carriers: Trolley system as required for track indicated, all steel with ball-bearing wheels, one carrier per panel.

5. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

6. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

7. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

G. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

H. Hinges for Closure Panels, Pass Doors, and Pocket Doors: Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

I. Provide ADA-compliant, trimless, no threshold Single Pass Door and hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

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

3.2 INSTALLATION

A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.

D, Broken, cracked, chipped, deformed, or unmatched panels are not acceptable. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

E. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust pass doors to operate smoothly and easily, without binding or warping.

C. Verify that safety devices are properly functioning.

3.4 CLEANING AND PROTECTION

A. Cleaning: Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Protection: Provide protection and maintain conditions in a manner acceptable to the manufacturer and installer that insure operable partitions are without damage or deterioration at time of Substantial Completion.

3.5 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION

SECTION 102600
WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient wall rails.
2. Stainless steel corner guards.
3. Impact-resistant wall coverings.

B. Related Sections:

1. Division 08 Section "Door Hardware" for metal armor, kick, mop, and push plates for doors.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impactresistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated involving color.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Wall Accent Rails: 12 inches long; include examples of joinery, end and corner caps, and field splices.
2. Corner Guards: 12 inches long; include examples of end caps.
3. Impact-Resistant Wall Covering: 6 by 6 inches square.
4. Door-Surface Protection: 6 by 6 inches square.

E. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of resilient products under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

F. Warranty: Sample of special warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection units in original undamaged packages and containers inside well area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
4. Store products either in a vertical or horizontal position as indicated by the manufacturer.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
   b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of wall protection products from a single source from a single manufacturer.

2.2 STAINLESS STEEL GUARDS

A. Corner Guards, Stainless Steel, Surface-Mounted: Fabricated as one-piece from formed metal with formed edges with 90 or 135-degree turn to match wall condition.

1. Material: Stainless steel, Type 304.

    a. Thickness: Minimum 0.0625 inch.
    b. Finish: Directional satin, No. 4.

2. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
3. Length: 48 inches.
4. Corner Radius: 1/8 inch.
5. Edges: Beveled.
6. Mounting: Oval head, countersunk screws through factory-drilled mounting holes.

B. End Wall Guards, Stainless Steel, Surface-Mounted: Fabricated as one-piece from formed metal, Ushaped with formed edges that covers entire end of wall.

1. Material: Stainless steel, Type 304.

    a. Thickness: Minimum 0.0625 inch.
    b. Finish: Directional satin, No. 4.

2. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
3. Length: 48 inches.
4. Corner Radius: 1/8 inch.
5. Edges: Beveled.
6. Mounting: Oval head, countersunk screws through factory-drilled mounting holes.

2.3 RESILIENT WALL PROTECTION UNITS

A. Surface Burning Characteristics for Resilient Products: Comply with ASTM E84 or UL 723; 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.

B. Basis-of-Design Manufacturer: Where named manufacturer and product are indicated, Design, Drawings, and Specifications are based on products manufactured by the following:

1. Construction Specialties Inc.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) Balco, Inc.
2) IPC Door and Wall Protection Systems; Division of InPro Corporation.
3) Korogard Wall Protection Systems; a division of RJF International Corporation.

C. Wall Rail, Resilient: Assembly consisting of continuous snap-on vinyl/acrylic cover installed over concealed, continuous retainer.

1. Basis-of-Design: Construction Specialties Inc.; Model FR-125 Accent Rail.
2. Cover: Extruded vinyl/acrylic (Acrovyn), minimum 0.078-inch wall thickness; as follows:

a. Profile: Extended half-round.

1) Dimensions: Nominal 1-1/8 inches high by 1-1/8 inch deep. 2) Surface: Shadow grain texture.

b. Color and Texture: As selected by Architect from manufacturer's full range of not less than 60 solid colors (See Drawings).

3. Continuous Retainer: Manufacturer’s standard continuous retainer of recycled vinyl/acrylic compound.
4. End Caps and Corners: Manufacturer’s standard prefabricated matching end and corner caps designed for installation with concealed mechanical fasteners; field adjustable for close alignment with snap-on cover.
5. Mounting: Continuous retainer to be surface mounted directly to solid backing in wall.
6. Surface-Burning Characteristics: ASTM E 84, Class 1, flame spread of 25 or less and smoke developed of 450 or less.

2.4 IMPACT-RESISTANT WALL COVERINGS

A. Impact-Resistant Sheet Wall Covering: Vinyl/acrylic rigid sheet wall-covering material. 1. Basis-of-Design: Design, Drawings, and Specifications are based on the following:

a. Construction Specialties Inc.; Acrovyn rigid sheet.

1) Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

a) Balco, Inc.

b) IPC Door and Wall Protection Systems; Division of InPro Corporation.

c) Korogard Wall Protection Systems; a division of RJF International Corporation.

2. Size: 48 by 96 or 120 inches.
3. Sheet Thickness: 0.060 inch.
4. Color: As selected by Architect from manufacturer's full range of not less than 60 solid colors (See Drawings).
5. Texture: Pebblette grain texture.
6. Trim and Joint Moldings: Manufacturer’s standard extruded vinyl/acrylic rigid plastic that matches sheet wall covering color.
7. Surface-Burning Characteristics: ASTM E 84, Class 1, flame spread of 25 or less and smoke developed of 450 or less.
8. Mounting: Adhesive.

B. Primers and Adhesive: Products supplied or recommended by manufacturer.

1. VOC Content: 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 MATERIALS

A. Vinyl/Acrylic Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impactresistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 1308.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

C. Stainless-Steel Sheet: ASTM A 240/A 240M.

D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.6 FABRICATION

A. Fabricate wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire ratings, and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Complete finishing operations, including painting and priming, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install wall protection products according to manufacturer’s written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

    a. Where splices occur in horizontal runs, splice retainers and plastic covers at different locations along the run, but no closer than 12 inches.
    b. Adjust end, top, and bottom caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 102800
TOILET ROOM 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 the following:

1. Toilet room accessories.
2. Diaper Changing Stations
3. Custodial accessories.
4. Underlavatory and undersink guards.

B. Related Sections:

1. Division 09 Section “Non-Structural Metal Framing” for backing and blocking for supports for toilet compartments.
2. Division 10 Section “Toilet Compartments” for toilet compartments.

1.3 SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Sample Warranty: For manufacturer's special warranty.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

C. Coordinate backing for mounting accessories with wall framing.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 (ten) or 15 (fifteen) years from date of Substantial Completion, warranty period as indicated in the Accessory schedule at the end of the Section.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Toilet room accessories and mounting heights of accessories to be used by persons with disabilities shall comply with accessibility requirements of the 2010 ADA Standards for Accessible Design and the 2022 California Building Code, Chapter 11B, “Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.”

B. Installation: Where accessories are to be usable by persons with disabilities, comply with regulatory requirements including, but not limited to the following:

1. Where accessories are provided, at least one of each type shall be accessible.
2. Accessories shall be located on an accessible route.
3. The height above the floor to any operating mechanism or point of use shall not exceed 40-inches.
4. Accessories with their bottom edge more than 27 inches above the floor shall not project more than 4 inches from the wall.
5. Mirrors located above lavatories or counter tops shall be installed with the bottom edge of the reflecting surface 40 inches maximum above the floor, mirrors not

located above lavatories or counter tops shall be installed with the bottom edge of the reflecting surface 35 inches maximum above the floor.

6. Toilet paper dispensers shall not be of a type that controls delivery or that does not allow for continuous paper flow.
7. Grab bars shall comply with CBC Section 11B-609. Grab bars and any wall surface adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around grab bars shall be as follows:

    a. 1-1/2 inch between the grab bar and the wall.
    b. 1-1/2 inch minimum between the grab bar and any projecting objects below and to the ends.
    c. 12 inches minimum between the grab bar and any projecting objects above.

2.2 TOILET ROOM ACCESSORIES

A. Toilet Room Accessories: Toilet room accessories shall be as indicated and scheduled on Drawings.

1. Basis of Design: Named manufacturers' products indicated in the accessory schedule for each accessory type indicated are for the purpose of establishing minimum requirements. Named products are based on the following manufacturer:

    a. Bobrick Washroom Equipment, Inc.

        1) Subject to compliance with requirements, provide products indicated or equivalent products by one of the following:

            a) American Specialties, Inc.
            b) Bradley Corporation.
            c) General Accessory Manufacturing Co. (GAMCO)

B. Locks and Keys: Lockable accessories shall be provided with cylindrical locks and all locks shall be keyed alike. Provide each lockable accessory with not less than one key.

C. Finish: Exposed stainless steel surfaces of accessories shall have a satin finish unless otherwise indicated.

2.3 DIAPER CHANGING STATIONS

A. Diaper Changing Stations: Horizontal unit that opens by manually folding down from a stored position and designed to support a minimum of 250 lb static load when opened.

1. Basis-of-Design Product: Drawings and Specifications are based on the following:

    a. Koala Kare Products; Model KB200 Horizontal Wall Mounted Baby Changing Station.

1) Subject to compliance with requirements, provide the named product or a comparable product subject to request for substitution.

2. Mounting: Surface mounted.
3. Projection from Wall: Not more than 4 inches from wall when closed, 24 inches maximum when open.
4. Width: 36 inches nominal.
5. Operation: Manually operated with pneumatic shock-absorbing mechanism for controlled opening and closing.
6. Material and Finish: Injection molded polypropylene having antimicrobial embedded into plastic material, in color selected by Architect from manufacturer's standard colors (Cream, gray, white, light brown).
7. Features and Accessories:

   a. Nylon safety strap at changing table.
   b. Integral hooks for bags or purses, not less than two.
   c. Built-in liner dispenser.

8. Standards: Diaper changing stations to comply with the following:

   a. ASTM F 2285 Standard Safety Performance Specification for Diaper Changing Tables for Commercial Use.
   b. ANSI Z535.4 Product Safety Signs and Labels.

9. Accessibility Requirements: Unit shall comply with requirements of the 2010 ADA Standards for Accessible Design and the California Building Code.

   a. Operable parts shall be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts or pull down the changing table shall not exceed 5 lbs.
   b. Knee and Toe Clearance: Width of 30 inches minimum, depth of 19 inches minimum/24 inches maximum, and vertical clearance of 27 inches minimum above the floor.
   c. Changing Table Height: 34 inches maximum above the floor.
   d. Reach Range: 48 inches maximum above the floor for forward reach range for hand holds to pull down the changing table, 40 inches maximum above the floor to dispenser outlets.

2.4 UNDERLAVATORY AND UNDERSINK GUARDS

A. Underlavatory and Undersink Guards: Antimicrobial, white molded-plastic underlavatory guard assemblies. Guard assemblies shall cover waste piping and hot and cold water supply piping, allow service access without removing coverings, and shall prevent contact with hot surfaces and/or sharp objects.

1. Basis-of-Design Product: Drawings and Specifications are based on the following:

   a. IPS Corp./Truebro; Lavguard2 series underlavatory guard.

1) Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

a) Plumberex Specialty Products, Inc.

2. Underlavatory and sink guards shall comply with ASME A112.18.9 or ASTM C 1822.
3. Locations: Provide guard assemblies at all lavatories and/or sinks in all toilet rooms, and at sinks in cabinets/counter tops that are indicated to be accessible to persons in a wheel chair.

2.5 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304 with satin finish, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel).

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. 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.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.
2. Confirm and coordinate mounting heights and locations of support backing for accessories that are to be accessible to persons with disabilities to insure installed accessories will comply with accessibility requirements when installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected; commencement of work constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install accessories according to manufacturers' written instructions and as indicated on Drawings. Use fasteners appropriate for substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Accessories such as grab bars, towel bars, paper dispensers and soap dispensers, provided on or within walls, shall be installed and sealed to protect structural elements from moisture. Sealant shall not be visible in the finished installation. Sealant shall be mildew resistant silicone sealant as specified in Division 7 Section “Joint Sealants.”

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

C. Diaper Changing Stations:

1. Changing Table Height: 34 inches maximum above the floor when deployed.
2. Knee Clearance: 27 inches minimum above the floor.
3. Changing tables located in multi-accommodation toilet rooms, when deployed, shall not obstruct the required width of accessible routes to other accessible fixtures or features within the room (Accessible routes shall be 44 inches minimum in width).
4. Changing tables shall not be located in toilet compartments of multi-accommodation toilet rooms.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.4 ACCESORY LOCATIONS

A. General: Accessories shall be provided at locations indicated on drawings, for locations where accessories are not indicated, provide accessories as follows:

1. Paper Towel Dispensers: Provide one surface mounted paper towel dispenser for each single sink or lavatory location; where multiple sinks or lavatories occur in the same room or area, provide one towel dispenser for every 2 sinks or lavatories.
2. Soap Dispensers: Provide one surface mounted soap dispenser for each sink or lavatory.
3. Toilet Tissue Dispensers: Provide one surface mounted toilet tissue dispenser for each water closet.
4. Seat Cover Dispensers: Provide one surface mounted seat cover dispenser for each water closet.
5. Grab Bars: Provide one 42-inch grab bar at the back of the water closet and one 48-inch grab bar at the side of the water closet for all wheel chair accessible water closets.

B. Underlavatory and Undersink Guards: Install guards at the following locations:

1. Lavatories: Install guards at all lavatories and handwash sinks.
2. Sinks: Install guards at all sinks designed for forward approach by a person using a wheelchair.

3.5 CONTRACTOR FURNISHED AND INSTALLED ACCESSORIES

A. The following accessories shall be furnished and installed by the Contractor at locations specified and/or as indicated on the Drawings:

Reference	Description
Grab Bars for wheelchair accessible water closets	Bobrick B-6806 x 42, B-6806 x 48 1-1/2 inch diameter, satin finish, concealed mounting with snap flange. At each wheelchair accessible water closet, provide one 48 inch grab bar at the side wall and one 42 inch grab bar at the wall behind the water closet.
Mirror	Bobrick B-165 Series (size as indicated on drawings) Mirror, channel frame, 1/2 x 1/2 x 1/2 type 430 stainless steel, bright finish, mitered corners, 1/4-inch mirror glass (10 year warranty), concealed mounting with theft resistant locking device. (Note: Mirrors require 1-inch clearance all around for securing to concealed mounting bracket).
Mop Holder	Bobrick B-223 x 36 Mop and Broom holder, surface mounted, type 304 stainless steel, 4 anti-slip mop holders with rubber cams.
Napkin Disposal Container	Bobrick B-270 (Contura Series) Sanitary napkin Disposal container, surface mounted (projects 3-13/16 inches from wall).

Reference	Description
Seat Cover Dispenser	Bobrick B-4221 (Contura Series) Seat cover dispenser, surface mounted, capacity of 250 single or half fold toilet seat covers, fills from bottom.
Soap Dispenser, wall mount	Bobrick B-4112 (Contura Series) Liquid soap dispenser, surface wall mounted, 40 oz. capacity, concealed mounting, projects 3-5/16 inch wall to push button.
Toilet Tissue Dispenser, surface mount	Bobrick B-4288 (Contura Series) Toilet tissue dispenser, surface mounted (6-inch projection from wall), multi-roll, non-controlled delivery with theft resistant spindle, holds (2) 5.25 inch rolls, Flush tumbler lock
Towel Dispenser	Bobrick B-4262 (Contura Series) Paper towel dispenser, surface mounted (projects 4-3/4 inches from wall), tumbler lock at top of cabinet, 400 C-fold or 525 multi-fold towels, projects 4-11/16 inch from wall. Provide with optional “TowelMate™” (Bobrick No. 4262-130).

END OF SECTION

SECTION 104313
DEFIBRILLATORS AND CABINETS

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. Cabinets for automated external defibrillators (AED).
2. Portable automated external defibrillator equipment.

1.3 SUBMITTALS

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

1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and door style. B. Maintenance Data: For equipment and cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of product from a single source cabinets through a single manufacturer.

1.5 COORDINATION

A. Coordinate size of cabinet to ensure that cabinet size will accommodate AED equipment and accessories.

B. Coordinate sizes and locations of cabinets with wall depths, wall framing, and blocking for anchorage of cabinets.

PART 2 - PRODUCTS

2.1 AUTOMATED EXTERNAL DEFIBRILLATOR (AED) EQUIPMENT

A. Basis of Design: Drawings and Specifications are based on the following:

1. Zoll; AED Plus Automatic External Defibrillator.

a. Subject to compliance with requirements, provide product indicated or submit a Request for Substitution.

B. AED Description: portable, self-contained, battery powered AED.

1. Size: 5.25 inches high x 9.5 inches wide x 11.5 inches deep.
2. Weight: 7 lbs.
3. Power: 10 Type 123A Photo Flash lithium manganese dioxide batteries.
4. Device Classification: Class II and internally powered per EN60601-1.
5. Design Standard: Meets applicable requirements of UL 2601, AAMI DF-39, IEC 601-2-4, EN606101, IEC60601-1-2.

2.2 CABINETS FOR AUTOMATED EXTERNAL DEFIBRILLATORS

A. Basis of Design: Drawings and Specifications are based on the following:

1. J. L. Industries, Inc., a division of Activar Construction Products Group; Model 1417 Lifestart Series AED Cabinet.

a. Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:

b. Larsen's Manufacturing Company.
c. Potter Roemer LLC.

B. Cabinet Type: Semi-recessed Cabinet, size suitable for AED equipment, box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Cabinet Construction: Nonrated.
2. Cabinet Material: Steel sheet.
3. Wall Recess: Cabinet shall require of wall recess of no more than 4 inches.
4. Projection from Wall: Cabinet, including trim and pull handles, shall not project more than 4 inches from the finished wall surface.
5. Inside Dimensions: Clear inside dimensions of 14 inches wide by 14 inches high by 6-3/4 inches deep, minimum.
6. Finish: Manufacturer's standard baked-enamel paint or powder coat finish for exposed and semiexposed surfaces.

a. Color: White.

C. Trim Style: Rolled edge trim with 3-inch nominal backbend depth as standard with manufacturer.

1. Material: Steel sheet matching cabinet.
2. Finish: Same as for cabinet.

D. Door Style: Full Glass with AED graphics/decal.

1. Door Material: Steel sheet.
2. Finish: Same as for cabinet.
3. Door Glazing: Acrylic
4. AED Graphics: Manufacturer’s standard.
5. Door Hardware: Manufacturer’s standard.

a. Pull: Manufacturer’s standard.
b. Lock: Manufacturer’s standard roller latch.
c. Hinge: Provide continuous hinge, of same material and finish as trim permitting door to open 180 degrees.

E. Alarm: Standard: 85 db (audible) cabinet-mounted alarm standard (battery operated) to protect against theft or tampering; alarm deactivated when door is closed.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Glass: Tempered float glass, ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

A. AED Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semi-recessed AED cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install cabinets at locations indicated.

B. AED Cabinets: Fasten cabinets to structure, square and plumb.

1. Mounting Height: Mount cabinets so that the top of equipment access or any operable parts will not exceed 48 inches above the finished floor.

3.4 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturer.

E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.
   3. Hangers for surface mounted fire extinguishers.

1.02 REFERENCES

A. CFC - California Fire Code, Section 906.

B. Title 19, CCR, California Code of Regulations, Public Safety, State Fire Marshal Regulations, Division 01, Chapter 3, Article 5.

C. UL Underwriters Laboratories Inc. Fire Protection Equipment.

D. ADA - Americans with Disabilities Act.
   1. ADA Standards - ADA Title II Regulations and their referenced ADA Standards for Accessible Design.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for fire extinguishers and cabinets required.

B. Manufacturer's installation instructions.

C. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 QUALITY ASSURANCE

A. Conform to Title 19-CCR, Division 01 Chapters 1 and 3, and CBC, Section 906 requirements for extinguishers.

B. Fire extinguishers shall have current certification tag attached.

C. Fire extinguishers must be UL certified.

D. Cabinets shall comply with CBC Section 11B-3.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance data for fire extinguishers to include in maintenance manuals.

B. Warranty as specified.

1.06 WARRANTY

A. Manufacturer: Furnish District with manufacturer's 6-year written warranty in which manufacturer agrees to repair or replace fire extinguishers that fails in materials or workmanship within specified warranty period. Failure includes, but is not limited to, the following:
   1. Failure of hydrostatic test according to NFPA 10.
   2. Faulty operation of valves or release levers.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Fire extinguishers and cabinets shall be furnished from only one manufacturer.

B. Fire extinguishers shall be UL listed, conforming with ANSI/UL 711, and bear UL "Listing Mark" for type, rating, and classification of extinguisher.

C. Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

D. Cabinets shall meet "ADA Standards for Accessible Design" and CBC requirements for mounting height and projection from wall. Comply with the most stringent.

E. Fire Extinguishing Agent: Provide clean agent which does not contain halons or HCFCs.

2.02 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Larsen's Manufacturer's Company, Ft. Lauderdale, FL.
   2. JL Industries, Ambassador Series (District Standard)
   3. Amerex Corporation, Los Angeles, CA, UL No. EX 2835.
   4. Ansul Inc, Marinette, WI., UL No. EX 2199.
   5. Kidde Mebane, NC., UL No. EX 966

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.03 EQUIPMENT

A. Fire Extinguishers:
   1. Types:
      a. Typical: Multipurpose dry chemical type.
         1) UL Rating 2A-10B:C.

      b. Kitchen: Wet chemical agent type
         1) Class K Rating
         2) The maximum travel distance from the cooking hazard area to the

Class K extinguisher shall not exceed 30 feet.

2. 5-pound capacity.
3. Positioning 48 inches max. to handle.

B. Fire Extinguisher Cabinets:
   1. Larsen's Mode: l “2409 R7", or equal.
      a. Mounting: Semi-recessed.
      b. Size: To fit specified extinguishers.
      c. Cabinet Trim: Square, 5/16-inch, flat.
      d. Door Style: "Vertical Duo," with acrylic panel.
      e. Latching Device: g. Latching Device: Accessibility Type Latching and locking hardware per CBC 11B, shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate operable parts shall not exceed 5 lbs.
      f. Material: Steel with Stainless Steel: No. 304 stainless with No. 4 finish. approved by District’s Representative.
      g. Provide mounting clips, suitable for extinguishers being provided, in each cabinet.

   2. Larsen’s Model: “2409 R4”
      a. Mounting: Semi-recessed.
      b. Size: To fit specified extinguishers.
      c. Cabinet Trim: Square, 5/16-inch, flat.
      d. Door Style: "Vertical Duo," with acrylic panel.
      e. Glaing: Clear tempered safety glass.
      f. Lettering: Vertical; white.
      g. Latching Device: Accessibility Type Latching and locking hardware per CBC 11B, shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate operable parts shall not exceed 5 lbs.
      h. Material: Steel with Stainless Steel: No. 304 stainless with No. 4 finish. approved by District’s Representative.
      i. Provide mounting clips, suitable for extinguishers being provided, in each cabinet.

PART 3 - EXECUTION

3.01 INSPECTION

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

B. Beginning of installation means acceptance of existing conditions.

3.02 INSPECTION BY REGULATORY AGENCIES

A. Schedule inspection with agencies and Owner.

B. Furnish approval certificates issued by jurisdictional authorities.

3.03 INSTALLATION

A. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

B. Fire extinguisher cabinets shall be located where shown and as required by the local fire department. Wherever exact location of units is not shown, assume one extinguisher per 75- foot radius (maximum 75-foot travel distance from any given point to an extinguisher). Exact locations shall be approved by the District's Representative.

C. Provide fire extinguisher in each fire extinguisher cabinet plus an additional 10 percent of each size for future use by District.

D. Provide specified mounting brackets for extinguishers located in rooms accessed by authorized personnel only and not located in cabinets.

E. Install cabinets in rated walls as required to maintain fire separation integrity of partition.

F. Inspect, charge, and tag the fire extinguishers within 30 days before date or inspection by fire department.

END OF SECTION

SECTION 107516
FLAGPOLES

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 ground-mounted aluminum flagpoles and accessories.

B. Owner-Furnished Material: Flags.

C. Related Sections:

1. Division 03 Section “Cast-in-Place Concrete” for concrete for setting flagpole foundation tubes.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.

1. Include section, and details of foundation system for ground-mounted flagpoles.

C. Delegated-Design Submittal: For flagpole assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Professional engineer shall be a structural engineer licensed in the State of California.

D. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:

1. Seismic Loads: According to SEI/ASCE 7 and the California Building Code for the location in which the project is located.
2. Wind Loads: According to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles," SEI/ASCE 7, and the California Building Code for the location in which the project is located.
3. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.2 FLAGPOLES

A. Basis of Design: Design, Drawings, and Specifications are based on the following:

1. Concord American Flagpole; Titan Series -IWW aluminum flagpole with internal winch and wire halyard.

a. Subject to compliance with requirements, provide product indicated or an equivalent product by one of the following:

1) LA Steelcraft.
2) Eder Flag Manufacturing Co., Inc.

B. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

C. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063.

1. Exposed Height: 30 feet above grade level.
2. Wall Thickness: 0.188 inches.
3. Top Diameter: 3-1/2 inches.
4. Base Diameter: 6 inches minimum.
5. Exposed Finish: Waxed satin finish.
6. Maximum Recommended Flag Size: 6 by 10 feet.
7. Construction: Construct flagpoles in one piece if possible, if more than one piece is necessary, comply with the following:

a. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
b. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

1. Flashing Collar: Same material and finish as flagpole.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, 6 inch diameter, 0.063-inch spun aluminum wall with gold anodic finish.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Neoprene or vinyl covered chromium-plated bronze or stainless-steel swivel snap hooks.

a. Provide four snap hooks per halyard (For two flags).

2.4 MISCELLANEOUS MATERIALS

A. Concrete: Comply with requirements in Division 03 Section “Cast-in-Place Concrete.”

B. Drainage Material: Crushed stone or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C 33, fine aggregate.

D. Elastomeric Joint Sealant: Nonsag urethane or silicone joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

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

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. 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.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

B. Gold Anodic Finish: AAMA 611, AA-M32C22A43 Class I, 0.018 mm or thicker; gold color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Place concrete, as specified in Division 03 Section "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use non-staining curing compound.

F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION

SECTION 122400
WINDOW SHADES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

B. Related Requirements:

1.02 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1.03 ACTION SUBMITTALS

A. Shop Drawings:

B. Product Data: Manufacturer's descriptive literature of controls, accessories, attachment brackets, and installation instructions. Include test reports from a qualified testing agency for each shade cloth verifying compliance with specified performance criteria.

C. Samples:

D. Shades Schedule:

E. Sustainable Design: Information necessary to establish and document compliance with the California Green Building Standards Code (CALGreen) goals for this Project.

1.04 INFORMATIONAL SUBMITTALS

A. Installer qualifications.

1.05 CLOSEOUT SUBMITTALS

A. Manufacturer's recommended maintenance procedures for each type of shade, control, and two sets of any special tools that are required for inclusion in District's Operations and Maintenance Manual.

B. Extended warranties.

C. Maintenance materials as specified.

1.06 QUALITY ASSURANCE

A. Qualifications:

B. Source Limitations:

C. Turn-Key Single-Source Responsibility: To control responsibility for performance of window shade systems, assign the design, engineering, and installation of window shade systems,

motors, controls, and electrical wiring specified in this Section to a single manufacturer and their authorized dealer/installer. The following shall be coordinated with the window shade manufacturer:

D. Mockup: Install window shade mockup at one location for each type of shade configuration to show full operation and appearance review by District's Representative.

1.07 MAINTENANCE MATERIAL

A. Furnish the following extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on shop drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings.

1.10 WARRANTY

A. Manufacturer: Furnish District with the following manufacturer warranties.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE REQUIREMENTS

A. Each shade shall extend the full height and width of the window opening where it occurs.

B. Drive Assembly:

C. Removal of shade shall not require disassembly of shade unit.

D. Shade Cloth:

E. Conduit as required for window shade electrical wiring shall be concealed.

F. Above-ceiling and concealed wiring shall be plenum-rated or installed in conduit.

G. Provide a system which has been designed, developed, and manufactured as a totally integrated unit. The system shall be furnished by a single-source supplier with a certification that all components including motor, shade fabrics, electrical controls, and override controls

have been designed and tested as a compatible system and will be available in the future for either replacement or add-on requirements.

2.02 SHADES

A. Manufacturers: MechoShades Systems Inc., Hunter Douglas Architectural, or equal.

B. Types: Hand chain and motorized. Manual controls to comply with Operable parts 11B-309.4 & be within reach ranges per 11B-308

C. Configurations: Where more than one shade occurs in a pocket, locate chains for shades on same side of pocket.

2.03 MATERIALS AND COMPONENTS

A. Shade Materials: Fire-retardant, PVC free.
   a. Transparency: 3 to 5 percent open.

B. Fascia: Extruded aluminum with specified custom paint finish. Secure without exposed fasteners.

C. Hembar: Concealed (sealed) hemtube at bottom.

D. Drive Assembly at Manual Shades: Factory set for size and travel of shades.

E. Chain at Manual Shades: No. 10 stainless steel bead chain formed in a continuous loop.

F. Miscellaneous Brackets, Fastenings, and Accessories: As detailed, or if not detailed, as recommended by shade manufacturer for conditions indicated on the Drawings or encountered.

2.04 POWER OPERATOR

A. Motor: Fractional horsepower asynchronous motor with reversible capacitor designed for intermittent operation.

B. Switching: To be coordinated with District’s Representative.

C. Controls: Provide 3-position rocker-type wall switch where indicated on the Drawings; switch and switch plate to match other switches provided under Division 26.

2.05 FABRICATION

A. Workmanship: Fabricate shades in accordance with manufacturer's specifications and as detailed, complete with accessories necessary for specified operation.

B. Coordinate special pocket closure trim as shown on the Drawings with fabrication of aluminum storefront framing.

C. Factory Finish on Exposed Aluminum: Polyvinylidene fluoride paint system using PVDF resin.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install shades in accordance with manufacturer's installation instructions.

B. Each shade shall extend the full height and width of the window opening where it occurs.

C. Coordinate motor-operated shade installation with requirements included in Division 26.

3.02 ADJUSTMENT AND CLEANING

A. Verify operation. Adjust clearances to ensure free operation.

END OF SECTION

SECTION 142100
MODULAR HYDRAULIC ELEVATOR SPECIFICATIONS

PART 1 - GENERAL

1.0 SUMMARY

A. Section Includes: Supply and complete installation and testing of the hydraulic passenger elevators indicated on Drawings including cylinders, plungers, pumping units, oil storage tanks, controllers, guide rails, and entrances.

B. Related Sections

1. Trench Excavation and Backfill: Section 312333.
2. Elevator Pit Concrete; Cast-In-Place Concrete: Section 03300.
3. Resilient Flooring: Section 096500.
4. Fire Detection and Alram System: Section 283100.
5. Telecommunications Infrastructure: Section 271000.

1.1 SUBMITTALS

A. Submit in accordance with Section 01300: Submittals and Section 01350:

1. Shop Drawings: Submit complete shop drawings, indicate control, power and piping diagrams. Include dimensioned plan of hoistway and machine room and full height section through hoistway.

2. Submit engineering calculations for the guide rail supporting brackets, splice locations, and jack(s) support beams and brackets.

3. Submit a complete list of all items to be furnished and installed under this Section.

B. Submit manufacturer's recommended installation procedures which, when approved by the architect, shall be the basis for inspecting and accepting or rejecting actual installation.

C. Samples: Submit samples showing full range of colors and textures of all finish materials specified including 2" x 3" sample of light-diffusing plastic ceiling panels.

D. Maintenance Manuals: Furnish to the inspector prior to final inspection, one bound maintenance manual containing specifications and instructions for the maintenance and adjustment of operating equipment and controls. Include with the special control directions, any special tools or testing equipment required.

E. Submit Project Record Drawings in accordance with Section 01720.

1. Submit one (1) set of 24" x 36" reproducible vellums.

1.2 QUALITY ASSURANCE

A. Work of this section shall conform to the following standards:

1. American National Standard Safety Code for Elevators (ANSI) A17.1
2. The National Electrical Code (NEC)
3. The American National Standard Specifications (ANSI) A117.1
4. “Minimum Passenger Elevator Requirements for Handicapped”, Third edition, as published by the National Elevator Industry, Inc.

A. Qualifications of Manufacturer: Elevator manufacturer shall be regularly engaged in the business of manufacturing elevators of the type specified and shall have a history of successful installations acceptable to the architect.

B. Qualifications of Installer: Provide a thoroughly qualified, trained and experienced person who shall be present at site and shall direct all work performed under this section.

1.3 PRODUCT HANDLING

A. Use all means necessary to protect the materials required by this section before, during and after installation and to protect the work form other trades. In the event of damage, immediately make all necessary repairs and replacements at no cost to the customer. All such costs shall be borne by the responsible party.

1.4 WARRANTY AND MAINTENANCE

A. Warranty: Provide special project warranty, signed by the contractor, installer and manufacturer, agreeing to replace/repair/restore defective materials and workmanship of elevator work during warranty period. “Defective” is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibrations, and similar unusual, unexpected and unsatisfactory conditions.

    1. The warranty period is for the earlier of 12 months starting on the date of acceptance by the State Elevator Inspector or 13 months from date of delivery of elevator unit(s).

B. Maintenance Service: Provide full maintenance service by skilled, competent employees of elevator installer for a period of 12 months following date of acceptance. Include monthly preventative maintenance, performed during normal working hours. Include repair/replacement of worn or defective parts or components and lubrication, cleaning and adjusting as required for proper elevator operation in conformance with specified service. Exclude only repair/replacement due to misuse, abuse, and accidents for neglect cause by persons other than Installer’s personnel.

C. Warranties: Provide coincidental product warranties where available for major components of elevator work. Submit with maintenance manuals.

PART 2 - PRODUCTS

2.0 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, Manufacturers offering products that may be incorporated in the work include but are not limited to the following:

1. Phoenix Modular Elevator Inc.
   4800 Phoenix Drive
   Mount Vernon, IL 62864
   (618) 244-2314

2.1 SYSTEMS AND EQUIPMENT

A. General characteristics:

1. Type: Oil hydraulic passenger.
   a. Hydraulic oil=AW32, combustible
2. Control: Electric-hydraulic passenger.
3. Capacities: 2500 lbs.
4. Speed: 100 FPM
5. Operation: Automatic selective collective. Controller shall be non-proprietary type and provide any special tools and instructions for repair and maintenance. Relay logic controllers not acceptable.
6. Car interior clear dimensions: As indicated on drawings. Cab clear height –7’-6’.
7. Hoistway Door: 3’-0’ x 7’-0’ clear, single slide entrance with approved “B” label, hollow metal.
8. Door Operation: Car and hoistway doors, medium speed, power operated.
9. Signals: Illuminated buttons in car operating panel, illuminated hall call station visible and audible “in-car lantern”.
10. Special Features: Emergency lighting and alarm bell, automatic failure protection, Braille symbols and access compliance provisions, infra-red beam door re-opening device, inspection switch, and hoistway access switch and car-top inspection station.
11. Travel: total travel distance (floor to floor) shall be as indicated in Drawings.
12. Power Supply: Alternating current, 208,220,440 volts 3 phase, 60 Hertz.
13. Dedicated Electrical Lines: Car lighting, 120 volts with lockable disconnect in Machine room, see NEC E620-53; Machine Room and elevator pit; Machine Room and Elevator receptacles. Install ¾” conduit from nearest telephone terminal cabinet to machine room. Conduit in machine room shall be rigid metallic from disconnect to controller. Terminate in 4-S box, + 6’-0” above floor, cover of box indelibly marked “ELEVATOR EMERGENCY TELEPHONE”.
14. Standby Power per CBC 3003.1: In buildings and structures where standby power is required or furnished to operate an elevator, the operation shall be in accordance with CFC Section 1203 and CBC Sections 3003.1.1 through 3003.1.5.
    a. Temperature and humidity control per CBC 3003.1.4: Where standby power is connected to elevators, the machine room machine space, control room and control space ventilation or air conditioning system shall be connected to the standby power source.

b. Emergency hoistway venting per CBC 3003.1.5: Where standby power is connected to elevators, the emergency hoistway ventilation system, if required, shall be connected to the standby power source.

B. Car Frame:

1. A car frame fabricated from formed or structural steel members shall be provided with bracing to support platform and car enclosure.
2. Car platform shall be formed steel.
3. Car frame shall be isolated from platen plate by means of rubber isolation mounts.

C. Elevator Cab:

1. Interior car finish shall be high-pressure plastic laminate. Colors shall be selected by the architect.
2. Provide 1-1/4" O.D. round stainless steel handrail(s) in car. Mount handrails 34" to top of rail from floor with a 1-1/2" clearance from wall.
3. Ventilation of car shall be a natural draft vent.
4. Drop ceiling shall have separate light diffusing polycarbonate panels.
5. Lighting: Provide 36" fluorescent light fixtures and bi-pin type lamps, energy-efficient type.
6. Provide wood subfloor ready to receive flooring as selected by the Architect. (To be installed by others).
7. Provide an emergency light and alarm unit approved for elevator use. Battery powered emergency units shall have a self-contained charging unit capable of maintaining a peak charge without damage to the battery.
8. Provide flush mounted stainless-steel car operating panel. (See Article 2.02, Paragraph H).
9. Provide a car top inspection station with an "emergency stop" switch and with constant pressure "up-down" direction buttons which shall make the normal operating devices inoperative and give the Inspector complete control of elevator.
10. Provide elevator emergency telephone. (See Article 2.02, Paragraph A.13).

D. Car Door:

1. Door finish shall be solid color enamel or stainless steel as selected by the architect.
2. Pre-opening of doors shall not be installed.
3. Doors shall be power-operated automatic opening and closing, connected to the hoistway door opposite by a movable clutch mechanism.

E. Hoistway Entrance Doors:

1. Hoistway entrance doors shall be hollow metal, horizontal sliding type and shall include frames, sills, doors, hangers, hanger supports, hanger covers, fascia plates, and all necessary hardware. Finish shall be solid color enamel or stainless steel as selected by the architect. Hoistway entrances shall be solid color enamel or stainless steel as selected by the architect and shall bear "B" Label. (DO NOT paint over labels on doors or frame).
2. Provide landing identification on the hoistway side of entrance doors. Stencil 4" high Arabic numerals 12" above the bottom and 12" below the top of the door panel. Paint color shall provide maximum visual contrast to background color.

F. Guide Rails:

Install code standard “T” shaped steel guide rails for car. All bolts shall have a minimum of 2 threads showing beyond fastening nut.

G. Elevator Door Safety System:

1. Infra-red curtain unit using beams of invisible infra-red light to protect passengers against closing elevator doors.
2. Provide system by the following manufacturers:
    a. Vantage/GAL
    b. Wittur
    c. Or approved equal.
3. Car doors shall have an electronic obstruction sensing, reopening device. Device shall automatically reinstate operation after blockage is cleared.
4. Door shall be held open for normal cycle of seven seconds and shall be reopened by beam interruption. Time shall be adjustable within control panel.

H. Car Operating Panel:

1. A flush-mounted stainless-steel operating panel shall be mounted in each car and shall contain all devices required for specified operation. Panel shall be hinged.
2. Push buttons in operating panel shall be installed between 35” and 54” above car floor.
3. Floor registration pushbuttons shall be metal with lighted floor Designation engraved and filled on each push-button. Emboss correct Braille designation on panel face immediately to left of each pushbutton.
4. Emergency “stop” and “alarm” pushbuttons, mounted 35” center to car floor, shall be metal with tactile symbols etched into pushbuttons or panel face. Alarm button shall be on left. Stop button shall be key operated only.
5. Provide door “open” and “close” pushbutton switches immediately above “stop” and “alarm” switches. Activated door “open” switch shall override automatic door closing circuit immediately, opening and holding door in fully open position until pushbutton is released. Activated door “close” switch shall override automatic door hold open timer circuit only and immediately start door closing operation but shall not override door protection devices.
6. Key operated switch in control panel shall control car lights. Switches for car lights, electronic door protection unit, and independent operation shall be operated with same key, but key shall not operate inspection switch.
7. Key switches for control of car mounted equipment and special operation of elevator shall be installed in operating panel above highest floor button.
8. Hoistway access switches and inspection switch in car shall operate with one key. This key shall not operate any other switch used for operating other elevator equipment or circuit logic.

I. Landing Requirements:

1. Hall call stations shall be #16-gauge stainless steel, satin finish, flush mounted, 42” center line to floor with a visual call registered indicator. Stations shall contain call

switches, call registered indicator. Stations shall contain call switches, call registered indicators and fire recall switch when applicable.

2. Provide push button or push button with key operated cutout switches. Key removable in “off” or “neutral” position only. Install lock cylinder in a way that will mechanically prevent rotation in mounting plate. Hall call switches shall be 6 pin key cylinders to match customer keyway. (See Finish Hardware Section).
3. Identify hoistway entrances, as to landing served, by permanently installing 1/8” thick metal plates on both jambs of frame. Plates shall be riveted in all 4 corners. Plates shall be centered 60” above floor. Etch plates with 2” high Arabic numerals and corresponding Braille symbol to left or below. Braille symbol and numeral shall be raised .030” above background.
4. At all landings, permanently install fire signs. Signs shall be mounted above call station and read “In case of fire use stairway for exit. Do not use elevator”. Sign shall be securely fastened with rivets.
5. Provide visible and audible “in-car lantern”, located on car door jamb, visible from proximity of hall call station, indicating direction of travel to persons waiting on landing.
6. When required by ASME A17.1/CSA B44, provide an elevator CMF audible and illuminating signal and reset switch in the FEO Designated Landing hall call fixture. Mount the signal and reset switch at a minimum of 7 inches above the “Up” hall call button.
7. Provide a CMF visual and audible signal system that conforms to ASME A17.1/CSA B44. Provide continuous verification of operability of the telephone line and immediate activation of audible and visual signals when verification means determines that the telephone line is not functioning. Provide illumination of visual signal at one second intervals. Provide a minimum of 65 dBA audible signal at 30 second intervals.

J. Operations:

Selective Collective Operation: Elevator shall be controlled automatically by means of push buttons in car marked to correspond with respective landings served and by “Call’ key switch at each hoistway opening. Momentary pressure on any button shall operate car, if all car and hoistway doors are closed. Stop switch and car push-button station, when in off position, will render elevator inoperative and which will enable attendant or passenger to stop at any point during its travel.

K. Hoistway Access:

Hoistway “Access” switches shall be provided at top landings and bottom, if required.

L. Emergency Operation (Fire Recall Circuit):

Emergency operation shall comply with local Code and provide following.

1. Emergency operation key switch at main floor, flush in wall, to return elevator to main floor with operating instructions etched on switch cover plate.
2. Non-self resetting smoke detectors shall be installed at each elevator landing except main landing, to cause elevator to return to main floor if activated. Smoke detectors shall be tied into elevator controller but not into any other detection system. Smoke detector system is not required in fully sprinkled buildings.

M. Elevator Controls:

Elevator controls shall cancel “up” direction demands and return car to bottom landing should main motor thermal protective device actuate on an overheat or fault condition. Controls shall prevent re-initiation of “up” demands until all thermal protective devices are reset to normal positions or fault cleared.

N. Jack Units:

1. Hydraulic jacks shall be supported on pit floor. Any space under jack base plate and pit floor shall be completely filled with non-shrink grout after installation.
2. Jack unit shall be of sufficient size to lift gross load height required and shall be factory tested to insure adequate strength and freedom from leakage. No brittle material, such as gray cast iron, shall be used in jack construction. Hydraulic jack cylinders shall be clean and free of all rust and debris.
3. Twin holeless, twin telescopic holeless or in-ground jacks, as travel dictates.

O. Power Unit:

1. Oil pumping and control mechanism shall be compactly and neatly designed.
2. Pump shall be specially designed and manufactured for oil-hydraulic elevator service. Hydraulic pump motor shall have continuous ground to main slab. Output of pump shall not vary more than 10% between “no load” and “full load” on elevator car.
3. Drive shall be by direct coupling.
4. Protect motors classed as intermittent duty against continuous operation with a magnetic switch and overload relays of sufficient number and size and an integral thermal sensor.
5. Thermal overload relays of main motor magnetic shall be manual reset. Protective operation of motor magnetic switch thermal overload relay or integral thermal sensor shall prevent operation of main device motor, but shall not prevent operation in down direction of elevator nor prevent normal operation of power door operator.
6. Hydraulic control valves shall be multi-control integral valve unit, with 2 direction leveling “soft-stop” features and manual lowering control.
7. Power unit assembly shall be designed and installed to prevent transmission of operation noise outside machine room.

P. Piping and Oil Supply:

1. Storage Tank: Storage tank shall be constructed of steel. Equip with a gate shut-off valve between tank outlet and pump inlet. An initial supply of oil, of proper grade, sufficient for proper operation shall be provided in installed. Oil tank shall be secured to meet seismic requirement of the code.
2. Sound Isolating Couplings: Install sound isolating coupling in oil line between pump and jack, located in the machine room.
3. Muffler: A blow-out proof muffler, designed to minimize transmission of fluid pulsation shall be installed in piping between pump and cylinder.
4. Hydraulic piping system shall be designed and installed without leaks.
5. Hydraulic lines between machine room and hoistway shall be installed above grade where possible. Underground lines shall have a heavy coating of non-corrosive mastic and a double wrapping of PVC pipe wrapping tape .01” thick or a continuous flexible .02” thick plastic sleeve.

6. Trenches shall be back-filled only after pipe installation has been approved by the site construction inspector.

Q. Keying:

Furnish to owner keys for every key-operated switch, including hoistway access, inspection and fireman recall switch.

R. Telephone Cable:

Install a braided shielded 2 conductor NO. 20 AWG telephone cable between car telephone cabinet and dialer backboard in elevator machine room. Conductors and shield shall be continuous between cabinet and junction box, installed in a legal wire way except for traveling cable. Shield shall be braided and one end grounded.

S. Traveling Cable:

Traveling cable shall be in accordance with National Electric Code, Type E, EO and ETT. Cables shall be U.L. approved.

T. Elevator Emergency Telephone:

1. Provide a complete and operational emergency elevator telephone. Auto dialer shall be programmed to automatically dial primary number and secondary number as specified by the owner.
2. Telephone Company shall provide a dedicated telephone line to be terminated at main telephone terminal backboard in a RJ-11 jack. RJ-11 jack shall be marked with telephone line number and labeled “ELEVATOR TELEPHONE”.

U. Elevator Visual Communication

Provide the elevator with a 2-way visual and disabled person’s communications call box in compliance with 2022 CBC. Call box shall include controller, camera, video screen, push buttons, and ethernet connection for connection to the building’s unclassified network.

PART 3 - EXECUTION

3.0 EXAMINATION

A. Prior to commencing elevator installation, examine prefabricated hoistway, hoistway openings pits and machine rooms as constructed; verify all critical dimensions and examine supporting structure and all other conditions under which elevator work is to be installed. Notify contractor in writing of any dimensional discrepancies or other conditions detrimental to the proper installation or performance of elevator work. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.1 INSTALLATION OF ELEVATOR SYSTEM

A. General:

Comply with manufacturer's instructions and recommendations for work required during installation.

B. Excavation for Pit:

Excavate for each elevator pit to accommodate installation of modular elevator unit; comply with applicable requirements of Division 2 "Excavation" sections.

C. Install modular elevator units plumb and accurately centered for elevator car position and travel; anchor securely in place.

D. Welded Construction:

Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

E. Coordination:

Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays. Use benchmarks, lines and levels designated by contractor to ensure dimensional coordination of the work.

F. Sound Isolation:

Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure and thereby to eliminate sources of structure-borne noise from elevator system.

G. Install piping connection between hoistway and machine room without routing underground where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.

H. Lubricate operating parts of system, including ropes, if any, as recommended by manufacturers.

I. Alignment:

Coordinate installation of hoistway entrances with installation of modular elevator unit for accurate alignment of entrances.

J. Leveling Tolerance:

½-inch, up or down, regardless of load and direction of travel.

K. Finish interior walls at hoistway entrances and trim to modular elevator unit. Provide sill or finish floor in area of hoistway door penetration in accordance with plans.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing:

Upon nominal completion of each elevator installation and before permitting use of elevator (either temporary or permanent), perform acceptance tests ad required and recommended by Code and governing regulations or agencies.

B. Operating Tests:

Load each elevator to its rated capacity and operate continuously for 30 minutes over its full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of pump motor (except submerged pumps) during 30-minute test period. Record failures of elevator to perform as required.

C. Advise contractor, owner, architect and inspection department of governing agencies in advance of dates and times tests are to be performed on elevators.

3.3 PROTECTION

A. At time of substantial completion of the elevator work (or portion thereof), provide suitable protective coverings, barriers, devices, signs or such other methods or procedures to protect elevator work from danger or deterioration. Maintain protective measures throughout remainder of construction period.

B. Provide similar protective measures for elevator units that will be placed in temporary service, including inspection and maintenance service during period of temporary service.

3.4 DEMONSTRATION

A. Instruct owner’s personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train owner’s personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Confer with owner on requirements for a complete elevator maintenance program.

B. Make a final check of each elevator operation with owner’s personnel present just prior to date of substantial completion. Determine that control systems and operating devices are functioning properly.

END OF SECTION 14240

SECTION 210000
FIRE PROTECTION GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.

B. Consult all other Sections to determine the extent of this work specified elsewhere.

C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:

1. California Building Code
2. California Electrical Code
3. California Plumbing Code
4. California Mechanical Code
5. California Energy Code
6. California Green Buildings Standard
7. California Fire Code
8. National Fire Protection Association

1.4 QUALITY ASSURANCE

A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner’s insurance underwriter.

B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities withing Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

A. Secure and pay for all permits, licenses, inspections, and fees required.

B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

A. Paint all exposed piping and supports.

B. See Division 09 for painting.

1.8 COORDINATION

A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.

B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.

C. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

D. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.

E. Pipes which pitch have right-of-way over those which do not pitch. For example, condensate drains and waste normally have right-of-way.

F. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

G. Coordination drawings: The contractor shall provide coordination drawings for all work in this section. All work shall be coordinated to clear work in other sections.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.

B. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.

C. Furnish all materials and equipment of the same type by the same manufacturer.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

A. No substitute materials or equipment may be installed without the written approval of the Architect.

B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents. All submittals for substitution must include comparison to show equal with scheduled equipment.

C. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.

D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

A. Submit shop coordination drawings, manufacturer's data, samples and test reports as specified.

B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.

D. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

E. Submittals will be returned to indicate appropriate action taken as follows:

1. No Exceptions Taken.
2. Make Corrections Noted. No Resubmittal Required.
3. Revise and Resubmit.
4. Rejected.
5. Not Reviewed.

F. Use electronic form acceptable to Architect for electronic submittals, containing the following information:

1. Project name.
2. Date.
3. Name and address of Architect and Engineer.
4. Name of Owner.
5. Name, address and contact information of Contractor.
6. Names and contact information of sub-contractor, manufacturer, and supplier.
7. Name of entity that prepared submittal.
8. Category and type of submittal.
9. Specification Section number and title.
10. Drawing number and detail references, as appropriate.
11. Transmittal number, numbered consecutively, and revision number clearly identified.
12. Each item submitted labeled or identified the same as on the drawings.

G. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.

H. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.

I. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

A. Drawings show general arrangement and location of piping and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of piping. Field verify all dimensions.

B. The exact locations of equipment and piping shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost.

C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.

B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.

C. Record drawings must include the following as a minimum:

1. Actual equipment locations.
2. Revisions or substitutions to equipment schedules.
3. Pipe size and routing.
4. Dimensional changes to drawings.
5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.

3.4 PROTECTION OF BUILDING

A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.

B. Provide proper protection and storage of all items and tools required.

C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer’s supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.

C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.

D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.

E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

F. Do not operate water systems until piping has been cleaned, disinfected and start-up strainers are in place.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 FURRING AND PIPE SPACES

A. Spaces provided in the design of the building shall be utilized and the work shall be kept within the furring lines established on the Drawings.

B. Ensure necessary clearances on trim plates at exposed penetrations of walls and floors. If sufficient room is not available above suspended ceiling or vertical shafts obtain clarification from Architect before work is started.

3.9 CUTTING AND PATCHING

A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.

B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.

C. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.

D. Provide sleeves for all piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 2” clearance all around between sleeve and piping. When piping is insulated, insulation shall pass continuously through sleeve with 2” clearance between insulation and sleeve or hole in existing construction.

3.10 ACCESS

A. Indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. No controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.

C. Access panels shall be 24” x 24” unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.

D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.

E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.11 SEISMIC RESTRAINTS

A. All equipment, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, NFPA13, and the California Building Code.

B. Piping shall be braced as follows:

1. Brace top of system riser.
2. Brace all feed and cross mains.
3. Brace branch lines that are 2 1/2" nominal diameter and larger.
4. Transverse bracings at 40’-0” on center maximum and shall be spaced as calculated in accordance with NFPA13.
5. Longitudinal bracings at 80’-0” on center maximum and shall be space as calculated in accordance with NFPA13.
6. Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24” of the elbow or tee and is connected to the largest pipe.
7. Do not use branch lines to brace main lines.

8. Provide flexibility in joints where pipes pass through building seismic or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators.

9. At vertical pipe risers, support the weight of the riser at a point or points above the center of gravity of the riser wherever possible. Provide lateral guides at the top and bottom of the riser and at intermediate points not to exceed 30’-0” on center.

10. No bracing is required if the top of single pipe is suspended 12” or less from the connection point at the supporting structural member.

3.12 MANUFACTURER’S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer’s application and recommendations, requirements, and instructions, and in accordance with Contract Documents.

B. Conflicts between manufacturer’s instructions and Contract Documents shall be brought to the Architect’s attention for resolution prior to installation.

C. Where requirements indicated in Contract Documents exceed manufacturer’s requirements, Contract Documents shall govern.

3.13 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping other than piping that serve the room for the following: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping or equipment above or within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.14 CATHODIC PROTECTION

A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.15 PIPING AND EQUIPMENT IDENTIFICATION

A. Furnish and install engraved nameplates with 1/4” minimum lettering at panel mounted control devices, manual control stations, power disconnects, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.

B. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20’ of pipe length.

C. Tag all valves with 2” diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.16 GUARANTEE

A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.17 TESTING

A. Test all equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

B. Provide initial main drain test in accordance with NFPA25 and record on General Information Sign at riser.

3.18 OPENINGS

A. Locating and sizing of all openings for piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.19 CLEAN-UP

A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner’s premises shall be left clean, and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner.

3.20 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner’s operating and maintenance personnel.

B. Instruct the Owner’s operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.

C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.21 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.

B. Provide the following equipment and maintenance information where applicable:

1. California NFPA 25 Edition (Based on 2013 CA amended Edition).
2. Product Data Sheets.
3. Record Drawings.

C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.

D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.

E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION

SECTION 210500
OVERHEAD FIRE PROTECTION SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 21 Sections apply to this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to furnish and install complete overhead fire sprinkler system as shown on the contract drawings in accordance with NFPA 13 which shall include, but not limited to overhead riser, equipment, piping, valves, bracing, and supports.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

1. Sprinklers.
2. Piping and fittings.
3. Hangers and supports.
4. Valves.
5. Sprinkler Head Cabinet.
6. Check Valves.
7. Alarm Bell.
8. Gauges and Accessories.
9. Coordination Drawings: plans and details, drawn to scale, on which piping is shown and coordinated with other installations, using input from installers of the items involved.
10. Site Survey: Plans, drawn to scale, on which fire service piping is shown and coordinated with other services and utilities.
11. Welding certificates.

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

1.4 QUALITY ASSURANCE

A. Steel support welding qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel.”

B. Pipe welding qualifications: Qualification procedures and operators.

C. Each length of pipe, fitting, or device used in any piping system shall be stamped or indelibly marked with type, weight, quality, and manufacturer’s name or mark.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pipes shall be shipped so as not to bend, dent, or otherwise damage the pipe during transport. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading. Any pipe found to have been damaged due to improper handling shall be removed from the jobsite at Contractor’s expense.

B. Hazardous liquids: Remove and dispose of liquids from piping according to requirements of authorities having jurisdiction.

C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

D. Store and handle pipes and tubes having factory-applies protective coatings to avoid damaging coating, and to protect from direct sunlight.

PART 2 – PRODUCTS

2.1 MATERIALS

A. See Schedules on Drawings for sprinkler heads. Furnish and install all sprinkler heads in accordance with Drawings, manufacturer’s recommendations, and all applicable codes.

B. All material shall be listed by Underwriters’ Laboratories.

C. Stainless steel piping shall be installed where underground piping is within 5’-0” of the building and under all footing.

D. Joints shall not be installed under building or footings.

E. All above grade sprinkler piping shall be UL listed for fire sprinkler use and meet ASTM A135 standards. Exposed exterior piping shall be factory galvanized and finish painted to match the building in accordance with Division 01. Schedule 40 piping shall be installed where threaded fittings are used. All other piping may be schedule 10 that is welded or roll grooved.

F. Escutcheons shall be provided where piping passes through walls, floors or ceilings. Escutcheons shall be finished as required by the architect to match the building in accordance with Division 01.

G. A spare head box shall be provided at each riser location with at least 2 of each type of heads used, total number of spare heads shall be in accordance with NFPA13 for the number of head scheduled for the building. A spare wrench shall be included for each type of head in the building.

H. Bushings are not allowed.

I. Head guards shall be provided for all head subject to mechanical damage (ie. low heads in mechanical rooms).

J. CSFM (California State Fire Marshal) approved, UL listed, 120V flow switches shall be used.

K. CSFM (California State Fire Marshal) approved, UL listed, 120V tamper switches shall be used.

L. CSFM (California State Fire Marshal) approved, UL listed, 120V, 10” alarm bell shall be used.

M. Alarm test station in accordance with NFPA13 shall be provided with control valve and orifice equal to one sprinkler head. Alarm test discharge shall discharge to a sanitary sewer receptacle.

2.2 HANGER AND BRACING

A. Acceptable manufacturers: Tolco, Bline or approved equal.

B. Hangers, braces and components shall be UL listed and meet the requirements of NFPA13.

C. Hanger and brace component capacities shall meet requires for the spacing and pipe sizes shown on the drawings.

2.3 PIPE AND FITTINGS

A. Above Grade Interior Piping: ASTM A135 UL listed fire sprinkler pipe (Schedule 40 with threaded fittings or schedule 10 with welded or roll grooved fittings) carbon steel pipe.

B. Above Grade Exterior Piping: ASTM A135 UL listed fire sprinkler pipe(Schedule 40 with threaded fittings or schedule 10 with welded or roll grooved fittings) carbon steel pipe, with factory hot dipped galvanized coating, finish painted to match building in accordance with Division 01.

C. Above Grade Fittings: Black ductile iron threaded fittings meeting requirements of ASTM A536 for 1 1/2” pipe and smaller, butt welded joints or roll grooved joint for pipes 2” and larger. Hot dipped galvanized coating for exterior fittings. SPF, Anvil, Victaulic or approved equal.

D. Seismic Joint: Metraflex Fireloop or approved equal.

2.4 VALVES

A. All valves shall be UL listed rated for 175 psi.

B. Main Drain: Nibco T-301 or approved equal.

C. Riser Check Valve: Tyco CV-1 or approved equal.

D. Control Valve: Tyco BFV-300 butterfly valve with tamper switches.

E. Inspector's Test: AGF Model 1011A Test and Drain with Model 7000 pressure relief valve set at 175 psi.

2.5 AIR VENT

A. Automatic float type air vent, ½" NPT inlet, ½" drain outlet, 5/64" orifice, brass construction for 175 psi service pressure, Potter PAV or approved equal.

2.6 SPRINKLER HEADS

A. Heads shall be provided by a single manufacturer, Tyco, Viking or approved equal.

B. Heads shall be automatic glass bulb type. All heads shall be ordinary or intermediate rating unless otherwise shown on the drawings. All heads shall be quick response type unless otherwise shown on the drawings. Tyco FRB or approved equal.

2.7 ALARM COMPONENTS

A. Flow Switch: Potter VSR with adjustable retard or approved equal. CSFM approved and UL listed.

B. Alarm Bell: Potter PBA12010, 10" 120V or approved equal. CSFM approved and UL listed.

2.8 HOSE CABINET AND RACK

A. Hose Cabinet: Croker 1000 series recessed hose cabinet, 20 gauge steel, white powder coat finish with full panel style door, clear wire glass with safety film, model 1834 pull handle, "FIRE HOSE" marking, and 3/8" flat trim.

B. Hose Rack Assembly: Croker 3000 series 1 ½"x1 ½" hose rack, complete with 1 ½" UL angle valve and UL 1 ½" Industrial Fog Nozzle.

C. Hose: 75 feet of 1 ½" poly lined hose.

2.9

2.10 ACCESSORIES

A. Spare Head Cabinet: Tyco Spare Head Cabinet.

B. Pressure Gauge: 4" FFPI-PG 300 psi air/water gauge with 3way valve gauge kit or approved equal.

C. Semi Recessed Escutcheon: Tyco Style 10, 15.., semi recessed escutcheon, finish as required by Architect or approved equal.

PART 3 – EXECUTION

3.1 PIPING GENERAL INSTALLATION

A. All piping shall be installed in a manner that is acceptable to DSA, the engineer, and the architect.

B. All piping shall be pressure tested and flushed in accordance with NFPA13.

C. Piping shall not run over switchboards, or electrical panels.

D. Pipe runs in masonry and concrete floors shall be sleeved for protection.

E. Sleeve all lines rising in footings.

F. Caulk space between pipes and sleeves in exterior walls with flexible material in accordance with NFPA13. Fire caulk rated wall penetrations.

G. Place escutcheons, stamped with #16 gauge steel and chromium plated, on pipes passing through sleeves in walls, floors or ceiling where exposed to view within a finished area.

H. Support piping in accordance with NFPA13

I. Anchor vertical risers in accordance with NFPA13.

J. All changes of direction of piping shall be made with fittings. Do not bend pipe.

K. Flash roof vent piping through roof with 24 gauge or heavier galvanized flashing. Make watertight with black fibrous mastic. Extend flashing into roofing felt 12” from pipes.

3.2 HANGER AND SUPPORT INSTALLATION

A. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Comply with NFPA13, details on DSA approved drawings, the manufacture’s listings and the California Building Code.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

C. Install longitudinal and lateral bracing as shown on the drawings in accordance with NFPA13.

D. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.3 PAINTING

A. Paint exposed, exterior metal piping with factory-applied paint or protective coating. Do not paint sprinkler heads.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.

b. Intermediate Coat: Exterior alkyd enamel matching topcoat.

c. Topcoat: Exterior alkyd enamel (flat).

d. Color: As selected by Architect.

B. Paint exposed, interior metal piping with factory-applied paint or protective coating. Do not paint sprinkler heads.

2. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.

b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex (flat).

d. Color: As selected by Architect.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

D. Refer to Division 09 for additional painting requirements.

3.4 SYSTEM ACCEPTANCE

A. Provide testing of all fire sprinkler piping at 200 psi for 2 hours in accordance with NFPA13. Such tests shall be done in the presence of the Owner's representative, and all Authorities Having Jurisdiction. The inspection authority having jurisdiction and the Engineer shall be notified a minimum of 48 hours prior to performance of all tests so that they may be witnessed. Existing fire sprinkler systems shall be tested at system pressure. Additions with 20 or more heads to existing fire sprinkler systems shall be isolated from the existing system and tested at 200 psi.

B. Provide the IOR and the Architect with the completed contractors test certificate in accordance with NFPA13.

C. The contractor shall provide a hydraulic design information sign attached to the riser in accordance with NFPA13 and template provided on the contract drawings. The sign shall be permanently marked weatherproof metal or rigid plastic.

D. The contractor shall provide a general information sign attached to the riser in accordance with NFPA13 and template provided on the contract drawings. The sign shall be permanently marked weatherproof metal or rigid plastic.

E. Contractor shall provide all apparatus, temporary work, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as the Contractor will be required to repair and make good, at own expense, any damage caused.

F. Any defects or deficiencies discovered as result of tests shall be immediately repaired and tests shall be repeated until all test requirements are fully met. No caulking of pipe joints to remedy leaks shall be permitted.

3.5 TRAINING AND O&MS

A. Refer to Section 21 00 00 Fire Protection General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

3.6 SIGNS

A. Install Hydraulic Design Information sign at riser in accordance with NFPA13-29.4 and the contract drawings

B. Install General Information Sign at riser in accordance with NFPA13-29.6 and the contract drawings.

END OF SECTION

SECTION 211000
UNDERGROUND FIRE SERVICE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 21 Sections apply to this Section.

1.2 SCOPE OF WORK

B. Provide labor, materials, equipment, and services to furnish and install complete underground fire service as shown on the contract drawings in accordance with, NFPA13 and NFPA24 which shall include, but not limited to underground fire service piping from in building riser to connection to a connection at 5 feet outside of building to the fire service specified under Division 33.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

1. Piping.
2. Fittings.
3. Mechanical Joint Restraint.
4. Bolt Up Sets.
5. Polyethylene Wrap.
6. Valves.
7. In Building Riser.
8. Warning Tape.
9. Coordination Drawings: plans and details, drawn to scale, on which piping is shown and coordinated with other installations, using input from installers of the items involved.
10. Site Survey: Plans, drawn to scale, on which fire service piping is shown and coordinated with other services and utilities
11. Welding certificates.

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

1.4 QUALITY ASSURANCE

A. Steel support welding qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel.”

B. Pipe welding qualifications: Qualification procedures and operators.

C. Each length of pipe, fitting, or device used in any piping system shall be stamped or indelibly marked with type, weight, quality, and manufacturer’s name or mark.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pipes shall be shipped so as not to bend, dent, or otherwise damage the pipe during transport. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading. Any pipe found to have been damaged due to improper handling shall be removed from the jobsite at Contractor’s expense.

B. Hazardous liquids: Remove and dispose of liquids from piping according to requirements of authorities having jurisdiction.

C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

D. Store and handle pipes and tubes having factory-applies protective coatings to avoid damaging coating, and to protect from direct sunlight.

A. DELIVERY, STORAGE, AND HANDLING

1.6 CONNECTIONS

A. The contractor shall provide underground service to approximately 5’-0” outside of the building or to top of In Building Riser approximately 1’-0” above finish grade as shown on the drawings.

PART 2 – PRODUCTS

2.1 PIPING

A. Underground fire service piping shall be DR14 C900 PVC, Manville Blue Brute or approved equal. Piping within 5 feet of buildings or under footings shall be Class 50 cement lined ductile iron.

B. Tracer wire minimum #10 awg copper, UL listed for direct burial.

C. Bituminous Tar Mastic meeting ASTM D 4541 standards, Christy’s HD50 or approved equal.

2.2 MECHANICAL JOINT RESTRAINT

A. Mechanical joint restraint for PVC piping shall be EBAA Iron Megalug series 2000PV or approved equal. Mechanical joint restraint for ductile iron piping shall be EBAA Iron Megalug series 1100 or approved equal.

B. Bell Restraint Harness for PVC or ductile iron piping shall be EBAA Iron Series 1500TD or approved equal.

2.3 THRUST BLOCKS

C. Thrust blocks shall be a minimum of 2000 psi strength concrete.

2.4 VALVES

A. All fire service valves shall be UL listed and by a single manufacturer, Clow, Mueller or approved equal.

2.5 BOLT UP SETS

A. All bolt up sets shall be 316 stainless steel.

B. Seismic Joint: Metraflex Fireloop or approved equal.

2.6 POLYETHYLENE ENCASEMENT

A. All metallic pipe fittings and appurtenances below grade shall be wrapped for protection from corrosive soil with a minimum of 8 mil polyethylene encasement in accordance with ASSI/AWWA C105/A21.5, Polyethylene encasement shall be Christy's Fitting wrap or approved equal

2.7 MASTIC

B. All metallic pipe fittings and appurtenances below grade shall be coated for protection from corrosive soil with a minimum of 18 mil bituminous coal tar mastic, Christy's HD 50 Bituminous Coal Tar Mastic or approved equal.

2.8 POST INDICATOR

A. Post indicators shall be UL listed, Clow style 2945 A or approved equal.

2.9 FIRE DEPARTMENT CONNECTION

A. A. Fire department connections shall be UL listed, Croker 6407 or approved equal.

2.10 CHECK VALVES

A. FDC inlet riser check valves shall be UL listed, brass body, FPPI TrimFit or approved equal.

B. FDC underground isolation check valves shall be UL listed cast iron, swing check, Nibco F-908-W or approved equal.

2.11 VALVE BOXES

A. Valve boxes shall be cast iron or concrete with cast iron cover rated for H20 traffic loading, Christy or approved equal.

2.12 FIRE HYDRANT

A. Fire hydrants shall be UL listed meeting local fire department requirements, typical one 4 or 4-1/2" pumper outlet and two 2 ½" hose outlets, Clow 960 or approved equal.

2.13 BACKFLOW ASSEMBLY

A. Double check detector assembly: Ames 3000SS or approved equal, size as indicated on plans.

B. Reduced pressure detector assembly: Ames M500 or approved equal, size as indicated on plans.

2.14 IN BUILDING RISER

A. The In Building Riser shall be UL listed one piece 304 stainless steel, Ames IBR or approved equal, size as shown on the plans.

2.15 TAMPER SWITCHES

A. Tamper switches shall be UL listed and CSFM approved. System sensor OS&Y or approved equal.

2.16 FIRE PUMP

A. Fire pump shall be UL listed, complete, skid mounted with factory enclosure meeting the standards of NFPA20. Capacity and power supply as shown on the drawings.

2.17 FIRE WATER STORAGE TANK

A. Fire water storage tank shall be steel bolted or welded tank meeting the standards of NFPA 22. Capacity as shown on the drawings.

PART 3 – EXECUTION

3.1 PIPING GENERAL INSTALLATION

A. All underground fire service piping shall be tested and flushed in accordance with NPFA 24. Testing and flushing shall be witnessed by DSA inspector of record. All piping shall be pressure tested and flushed in accordance with NFPA13.

B. Thrust blocks and mechanical joint restraint shall be provided at all changes in direction.

C. All non-metallic piping shall have tracer wire and marking tape installed. Tracer wire shall be strapped to pipe every 5 feet. Tracer wire shall be accessible at every riser on valve box Sleeve all lines rising in footings.

D. All metallic pipe and fittings shall be coated and wrapped.

E. Metallic pipe and fittings shall be protected from corrosive soil conditions with polyethylene wrap.

F. Ductile iron pipe shall be used within 5 feet of buildings and under footings.

3.2 EXCAVATION AND BACKFILL

A. Any work damaged by excavation or backfilling shall be repaired at the contractor’s expense.

B. Piping shall be bedded on a minimum of 6” of clean sand with backfill of sand or clean gravel to 6” above pipe. Compaction not exceeding 8” lifts to 95% density in accordance with AASHO Standard T-99.

3.3 HYDRANTS

A. Hydrants shall be set plumb with pumper outlet facing the access roadway. The pumper outlet shall be no less than 18” or more than 36” above the access roadway.

B. 6” minimum run out with gate valve shall connect each hydrant to the fire service main.

C. Thrust block and mechanical joint restraint shall be provided at all changes in direction.

3.4 CORROSION PROTECTION

A. All metallic piping fitting, bolts, etc shall be coated in a minimum of 18 mils of bituminous coal tar mastic and the wrapped with a minimum of 8 mils of polyethylene fitting wrap for corrosive soils conditions.

B. All bolt-up sets (nuts, bolts, and washers) and tie rods for valves, fittings, and buries shall be stainless steel, ASTM A-276 type 316

3.5 TESTING, ADJUSTING, AND CLEANING

A. Provide testing of all fire sprinkler piping at 200 psi for 2 hours in accordance with NFPA24. Such tests shall be done in the presence of the Owner's representative, and all Authorities Having Jurisdiction. The inspection authority having jurisdiction and the Engineer shall be notified a minimum of 48 hours prior to performance of all tests so that they may be witnessed.

B. Provide the IOR and the Architect with the completed contractors test certificate in accordance with NFPA24.

C. Contractor shall provide all apparatus, temporary work, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as the Contractor will be required to repair and make good, at own expense, any damage caused.

D. Any defects or deficiencies discovered as result of tests shall be immediately repaired and tests shall be repeated until all test requirements are fully met. No caulking of pipe joints to remedy leaks shall be permitted.

3.6 TRAINING AND O&MS

A. Refer to Section 21 00 00 Fire Protection General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION

SECTION 220516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS SUMMARY

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. Flexible-hose packless expansion joints.
   2. Metal-bellows packless expansion joints.
   3. Pipe loops and swing connections.
   4. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 SUBMITTALS

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

B. Submittal to include but not limited to:
   Construction details, material descriptions, dimensions of individual components, finishes, rated capacities, operating characteristics, furnished specialties, and accessories.

C. Welding certificates.

D. Product Certificates: For each type of expansion joint, from manufacturer.

E. Maintenance Data: For expansion joints to include in maintenance manuals.

1.5 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:
   1. Manufacturers: Subject to compliance with requirements, provide available manufacturers offering products that may be incorporated into the Work include, but not limited to one of the following:

2. Standards: For potable water service, connectors shall be UL classified in accordance with ANSI/NSF 61 Standards:
    a. Flex-Hose Co., Inc.
    b. Flexicraft Industries.
    c. Metraflex, Inc.
    d. Unisource Manufacturing, Inc.
3. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose. Flexible loops shall have a factory supplied, center support, nut located at the bottom of the 180-degree return, and a drain/air release plug.
4. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
5. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
6. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.
7. Expansion Joints for Steel Piping NPS 2 and Smaller: Stainless-steel fittings with threaded end connections.
    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.
8. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Stainless-steel fittings with flanged end connections.
    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.

B. Metal-Bellows Packless Expansion Joints:
9. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Adsco Manufacturing LLC.
    b. Badger Industries, Inc.
    c. Expansion Joint Systems, Inc.
    d. Flex-Hose Co., Inc.
    e. Flexicraft Industries.
    f. Flex Pression Ltd.
    g. Flex-Weld, Inc.
    h. Flo Fab inc.
    i. Hyspan Precision Products, Inc.
    j. Metraflex, Inc.
    k. Proco Products, Inc.
    l. Senior Flexonics Pathway.
    m. Tozen Corporation.
    n. Unaflex.
    o. Unisource Manufacturing, Inc.
    p. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
    q. U.S. Bellows, Inc.

r. WahlcoMetroflex.

10. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
11. Type: Circular, corrugated bellows with external tie rods.
12. Minimum Pressure Rating: .175 psig unless otherwise indicated.
13. Configuration: Single joint with base and double joint with base classes unless otherwise indicated.
14. Expansion Joints for Copper Tubing: Multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
    a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint.
    b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Solder joint.
    c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.

2.2 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

15. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Adsco Manufacturing LLC.
    b. Advanced Thermal Systems, Inc.
    c. Flex-Hose Co., Inc.
    d. Flexicraft Industries.
    e. Flex-Weld, Inc.
    f. Hyspan Precision Products, Inc.
    g. Metraflex, Inc.
    h. Senior Flexonics Pathway.
    i. Unisource Manufacturing, Inc.
    j. U.S. Bellows, Inc.
16. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

17. Steel Shapes and Plates: ASTM A 36/A 36M.
18. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
19. Washers: ASTM F 844, steel, plain, flat washers.
20. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
    a. Stud: Threaded, zinc-coated carbon steel.
    b. Expansion Plug: Zinc-coated steel.
    c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

C. Install factory fabricated flexible-hose packless expansion loops in accordance with the manufacturer’s written installation instructions.

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guides on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:
   1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
   3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
   4. Anchor Attachment to Steel Structural Members: Attach by welding.
   5. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION

SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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

B. Section Includes:
   1. Sleeves.
   2. Stack-sleeve fittings.
   3. Sleeve-seal systems.
   4. Sleeve-seal fittings.
   5. Grout.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wall Sleeves: R-K Industries, No. 100 (wall) and No. 10 (deck).
   2. Pipe Sleeves: Zurn Z 195 and/or fabricated sleeve, or equal. Sleeves shall have membrane clamping rings and penetrations shall be sealed, water proof sleeves.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Smith, Jay R. Mfg. Co.
   2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

C. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, Inc.

2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   a. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   b. Pressure Plates: Stainless steel.
   c. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Presealed Systems.

D. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

E. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

F. Characteristics: Nonshrink; recommended for interior and exterior applications.

   Design Mix: 5000-psi, 28-day compressive strength.

G. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

F. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

G. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

H. Install sleeve-seal fittings in new walls and slabs as they are constructed.

I. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.

J. Secure nailing flanges to concrete forms.

K. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

L. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-wall sleeves.
2. Exterior Concrete Walls below Grade:
    a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
    a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
    a. Piping Smaller Than NPS 6: Sleeve-seal fittings.
5. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
c. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 220518
ESCUTCHEONS FOR PLUMBING PIPING

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. Escutcheons.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and setscrew fastener.

C. One-Piece, Stamped-Stainless Steel Type: With chrome-plated finish and setscrew fastener.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.2 FIELD QUALITY CONTROL

C. Replace broken and damaged escutcheons using new materials.

END OF SECTION

SECTION 220519
THERMOMETER AND GAUGES FOR PLUMBING PIPING

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. Bimetallic-actuated thermometers.
   2. Filled-system thermometers.
   3. Liquid-in-glass thermometers.
   4. Thermowells.
   5. Dial-type pressure gauges.
   6. Gauge attachments.
   7. Test plugs.
   8. Test-plug kits.
   9. Sight flow indicators.

1.3 SUBMITTALS

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

C. Product Certificates: For each type of meter and gauge, from manufacturer.

D. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ashcroft Inc.
   2. Trerice, H. O. Co.
   3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   4. Weiss Instruments, Inc.
   5. WIKA Instrument Corporation - USA.
   6. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: 5-inch diameter non-reflective aluminum with permanently etched scale markings and scales in degrees F scale range 30 to 240 degrees Fahrenheit.

E. Connector Type(s): Union joint, adjustable angle and rigid, bottom, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range 30 to 240 degrees Fahrenheit.

2.2 FILLED-SYSTEM THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ashcroft Inc.
   2. Trerice, H. O. Co.
   3. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: Sealed type, cast aluminum or drawn steel; 5-inch nominal diameter.

D. Element: Bourdon tube or other type of pressure element.

E. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.

F. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C. Provide scale range 30 to 240 degrees Fahrenheit.

G. Pointer: Dark-colored metal.

H. Window: Glass.

I. Ring: Stainless steel.

J. Connector Types: Union joint, rigid, back and rigid, bottom; with ASME B1.1 screw threads.

K. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
   1. Design for Thermowell Installation: Bare stem.

L. Accuracy: Plus or minus 1 percent of scale range. Scale range 30 to 240 degrees Fahrenheit.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Flo Fab Inc.
      b. Miljoco Corporation.
      c. Palmer Wahl Instrumentation Group.
      d. Tel-Tru Manufacturing Company.
      e. Trerice, H. O. Co.
      f. Weiss Instruments, Inc.
      g. Winters Instruments - U.S.
   2. Standard: ASME B40.200.
   3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
   4. Case Form: Adjustable angle unless otherwise indicated.
   5. Tube: Glass with magnifying lens and blue or red organic liquid.
   6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in degrees Fahrenheit. Scale range 0 to 250 degrees Fahrenheit.
   7. Window: Glass.
   8. Stem: Aluminum and of length to suit installation.
      a. Design for Thermowell Installation: Bare stem.
   9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
   10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range. Scale range 30 to 240 degrees Fahrenheit.

2.4 THERMOWELLS

A. Thermowells:
   1. Standard: ASME B40.200.
   2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
   3. Material for Use with Copper Tubing: CNR or CUNI.
   4. Material for Use with Steel Piping: CRES.
   5. Type: Stepped shank unless straight or tapered shank is indicated.
   6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, NPS 25, ASME B1.20.1 pipe threads.
   7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
   8. Bore: Diameter required to match thermometer bulb or stem.
   9. Insertion Length: Length required to match thermometer bulb or stem.
   10. Lagging Extension: Include on thermowells for insulated piping and tubing.
   11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAUGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMETEK, Inc.; U.S. Gauge.
      b. Ashcroft Inc.
      c. Ernst Flow Industries.
      d. Trerice, H. O. Co.
      e. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
      f. Weiss Instruments, Inc.
      g. WIKA Instrument Corporation - USA.
      h. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi .
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.6 GAUGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball with NPS 1/4, ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flow Design, Inc.
2. Peterson Equipment Co., Inc.
3. Trerice, H. O. Co.
4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
5. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.8 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometers, one pressure gauge and adapter, and carrying case. Thermometer sensing elements, pressure gauge, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gauge: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.9 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Archon Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Brooks Instrument.
4. Ernst Flow Industries.
5. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
6. OPW Engineered Systems; a Dover company.
7. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 150 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

H. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.

I. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

J. Install thermowells with extension on insulated piping.

K. Fill thermowells with heat-transfer medium.

L. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

M. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.

N. Install valve and snubber in piping for each pressure gauge for fluids.

O. Install test plugs in piping tees.

P. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.
   2. Suction side of each hot water circulator.

Q. Install pressure gauges in the following locations:
   1. Building water service entrance into building.

3.2 CONNECTIONS

R. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

3.3 ADJUSTING

S. Adjust faces of meters and gauges to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
   1. Liquid-filled sealed, bimetallic-actuated type.
   2. Direct-mounted, metal-case, vapor-actuated type.
   3. Industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.6 PRESSURE-GAUGE SCHEDULE

A. Pressure gauges at discharge of each water service into building shall be direct-mounted, metal-case, dial-type pressure gauges:

B. Pressure gauges at outlet of the domestic hot-water storage tank shall be direct-mounted, metal case, dial-type pressure gauges:

3.7 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

C. Scale Range for Water Service Piping: 0 to 160 psi.

D. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION

SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Brass ball valves.
   2. Bronze ball valves.
   3. Bronze swing check valves.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

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

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle and gate valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1. Gate Valves: With rising stem.
   2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

D. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Grooved: With grooves according to AWWA C606.
   3. Solder Joint: With sockets according to ASME B16.18.
   4. Threaded: With threads according to ASME B1.20.1.

E. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sioux Chief 648 Series.
      b. Or equal.
   2. Description:
      a. Standard: MSS SP-110.
      b. CWP Rating: 400 psig.
      c. Body Design: One piece.
      d. Body Material: Forged brass.
      e. Ends: Threaded.
      f. Seats: PTFE or TFE.
      g. Stem: Brass.
      h. Ball: Chrome-plated brass.
      i. Port: Full Port.

2.3 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Conbraco Industries, Inc.; Apollo Valves.

c. NIBCO INC.
d. Sioux Chief

2. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Conbraco Industries, Inc.; Apollo Valves.
b. NIBCO INC.

2. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Reduced.

2.4 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Kitz Corporation.
d. Sure Flow Equipment Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Sioux Chief

2. Description:
a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Jenkins Valves.
      d. Crane Co.; Crane Valve Group; Stockham Division.
      e. Hammond Valve.
      f. Kitz Corporation.
      g. Milwaukee Valve Company.
      h. NIBCO INC.
      i. Powell Valves.
      j. Red-White Valve Corporation.
      k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      l. Sioux Chief.
   2. Description:
      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 200 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B 62, bronze.
      e. Ends: Threaded.
      f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

F. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

G. Locate valves for easy access and provide separate support where necessary.

H. Install valves in horizontal piping with stem at or above center of pipe.

I. Install valves in position to allow full stem movement.

J. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

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

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

L. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or plug valves.
   2. Throttling Service: Ball valves.

M. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

N. Select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   2. For Copper Tubing, NPS 2-1/2 to NPS 3: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
   3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
   4. For Steel Piping, NPS 2-1/2 to NPS: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

O. Pipe NPS 2 and Smaller:
   1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Bronze Angle Valves: Class 125 Class 150, bronze nonmetallic disc.
   3. Ball Valves: One-piece, full port, brass or bronze with bronze trim.
   4. Bronze Swing Check Valves: Class 125 Class 150, bronze disc.
   5. Fixture stops: Sioux Chief 648 Series SS ball valve with threaded or socket connections.

END OF SECTION

SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Copper Pipe Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

C. Suspension pipe clamp: Oatey #33915 or equal shall be used to eliminate contact between piping and framing surface for noise-reduction.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Non-MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International; a subsidiary of Mueller Water Products Inc.
      b. Empire Industries, Inc.
      c. ERICO International Corporation.
      d. Haydon Corporation; H-Strut Division.
      e. NIBCO INC.
      f. PHD Manufacturing, Inc.
      g. PHS Industries, Inc.
   2. Description: Shop or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4.
   4. Channels: Continuous slotted steel channel with in-turned lips.
   5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
   7. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carpenter & Paterson, Inc.
   2. Clement Support Services.
   3. ERICO International Corporation.
   4. National Pipe Hanger Corporation.
   5. PHS Industries, Inc.
   6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
   7. Piping Technology & Products, Inc.
   8. Rilco Manufacturing Co., Inc.
   9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

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

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
      b. NPS 4: 12 inches long and 0.06 inch thick.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

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

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

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

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
   10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
   11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   13. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

M. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   1. Light (MSS Type 31): 750 lb.
   2. Medium (MSS Type 32): 1500 lb.
   3. Heavy (MSS Type 33): 3000 lb.
   4. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 220548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

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. Spring hangers.
   2. Pipe riser resilient supports.
   3. Resilient pipe guides.
   4. Restraining braces and cables.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Coordination Drawings: Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

C. Welding certificates.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

B. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
   1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
   2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

C. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

D. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and re-insertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

E. Acoustical plumbing isolators such as Oatey #33915 to be used to eliminate contact between piping and framing surface for noise reduction.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

B. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

C. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

D. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Piping Restraints:
1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Install cables so they do not bend across edges of adjacent equipment or building structure.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.3 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel rivets or self-tapping screws.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. Near major equipment items and other points of origination and termination.

B. Pipe Label Color Schedule:
   1. Domestic Hot Water Piping:
      a. Background Color: Red.
      b. Letter Color: Black.
   2. Domestic Cold-Water Piping:
      a. Background Color: Green.
      b. Letter Color: White.
   3. Sanitary Waste Piping:
      a. Background Color: White.
      b. Letter Color: Black.

END OF SECTION

SECTION 220700
PLUMBING INSULATION

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. Insulation Materials:
      a. b. Cellular glass.
      b. c. Flexible elastomeric.
      c. d. Mineral fiber.
   2. Adhesives.
   3. Mastics.
   4. Lagging adhesives.

1.3 SUBMITTALS

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

1.4 COORDINATION

A. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cell-U-Foam Corporation; Ultra-CUF.
      b. Pittsburgh Corning Corporation; Foamglas Super K.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.

6. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.

F. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000 Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-35.
      b. Foster Products Corporation, H. B. Fuller Company; 30-90.
      c. ITW TACC, Division of Illinois Tool Works; CB-50.
      d. Marathon Industries, Inc.; 590.
      e. Mon-Eco Industries, Inc.; 55-40.
      f. Vimasco Corporation; 749.
   2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
   5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Childers Products, Division of ITW; CP-10.
      b. Foster Products Corporation, H. B. Fuller Company; 35-00.
      c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
      d. Marathon Industries, Inc.; 550.
      e. Mon-Eco Industries, Inc.; 55-50.
      f. Vimasco Corporation; WC-1/WC-5.
   2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 200 deg F.
   4. Solids Content: 63 percent by volume and 73 percent by weight.
   5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
   1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products, Division of ITW; CP-52.
      b. Foster Products Corporation, H. B. Fuller Company; 81-42.
      c. Marathon Industries, Inc.; 130.
      d. Mon-Eco Industries, Inc.; 11-30.
      e. Vimasco Corporation; 136.
   3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
   4. Service Temperature Range: Minus 50 to plus 180 deg F.
   5. Color: White.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

3.6 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot Water:
   1. NPS 1 and Smaller: Insulation shall be one of the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1” up to 4”: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1-1/2 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
      d. Phenolic: 1-1/2 inch thick.
      e. Polyisocyanurate: 1-1/2 inch thick.
      f. Polyolefin1-1/2 inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

END OF SECTION

SECTION 221116
DOMESTIC WATER PIPING

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 PERFORMANCE REQUIREMENTS

A. General
   1. Capable of safely accepting indicated external forces without failure.
   2. Maintain equipment, piping in a captive position.

B. Criteria: Design for seismic forces specified in the Seismic Restraint Manual Guidelines for Mechanical Systems First Edition, 1991, published by Sheet Metal And Air Conditioning Contractors National Association, SMACNA.

1.3 SUBMITTALS

A. Product Data: For the following products:
   1. Specialty valves.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Backflow preventers.
   5. Water penetration systems.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Water Piping: Inside Building and Exposed: Type "L" copper pipe, hard drawn, 95/5 (no Lead) solder with cast wrought copper solder fittings and adapters for screw pipe connections. Water Piping Inside the building concealed: Schedule 40 CPVC plastic pipe with schedule 80 solvent weld fittings. Provide Hilti FS-ONE High Performance Intumescent Firestop Sealant with CPVC, PVC plastic piping. Piping CPVC - mount with plastic.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
   1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
   2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Elkhart Products Corporation; Industrial Division.
      2) NIBCO INC.
      3) Viega; Plumbing and Heating Systems.
   b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
   c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
6. Copper Push-on-Joint Fittings:
   a. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1) NVent LLC.
   b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.
7. Copper-Tube Extruded-Tee Connections:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) T-DRILL Industries Inc.
   b. Description: Tee formed in copper tube according to ASTM F 2014.
8. Grooved-Joint Copper-Tube Appurtenances:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Anvil International.
      2) Shurjoint Piping Products.
      3) Victaulic Company.
   b. Copper Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
   c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.
   1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
   2. Copper Pressure-Seal-Joint Fittings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Elkhart Products Corporation; Industrial Division.
         2) NIBCO INC.
         3) Viega; Plumbing and Heating Systems.
      b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
      c. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, Schedule 80.
   1. CPVC Socket Fittings: ASTM F 439 for Schedule 80.
   2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.4 PIPING JOINING MATERIALS

A. For all domestic hot water piping provide Ethylene Propylene Diene Monomer (EPDM) M-Class rubber formulated to be resistant to Chloramine or provide Fluorocarbon (FKM) or Silicone (VMQ) formulated to be resistant to Chloramine for gasket material in the domestic hot water system including but not limited to:
   1. Piping connections
   2. Equipment Connections
   3. Isolation Valves
   4. O-rings

B. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, Chloramine resistant as stated above; full-face or ring type unless otherwise indicated.

C. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
   1. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Sheet or Tube.

C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.

D. Color: Black.

2.6 SPECIALTY VALVES

A. All plumbing valves upstream from the apartment shutoff shall be brass. The apartment shutoff valves shall be brass body but can have CPVC socket connections (Sioux Chief 648 series brass ball valve w/ CPVC socket connections or equal). Inside apartments –brass valves, shut offs and fixture stops can be CPVC. In building types where apartment shut offs do not exist but CPVC is allowed, all valves that would require shutting more than 1 apartment

down if they need to be replaced shall be brass bodied ball valves similar to apartment shut off valve specified (Sioux Chief or equal).

B. CPVC Union Ball Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Asahi/America, Inc.
      c. IPEX Inc.
      d. NIBCO INC.
   2. Description:
      a. Standard: MSS SP-122.
      b. Pressure Rating: 150 psig at 73 deg F.
      c. Body Material: CPVC.
      d. Body Design: Union type.
      e. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
      f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded.
      g. Ball: CPVC; full port.
      h. Seals: PTFE or EPDM-rubber O-rings.
      i. Handle: Tee shaped.

C. CPVC Non-Union Ball Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Asahi/America, Inc.
      c. NIBCO INC.
      d. Spears Manufacturing Company.
      e. Thermoplastic Valves Inc.
   2. Description:
      a. Standard: MSS SP-122.
      b. Pressure Rating: 150 psig at 73 deg F.
      c. Body Material: CPVC.
      d. Body Design: Non-union type.
      e. End Connections: Socket or threaded.
      f. Ball: CPVC; full or reduced port.
      g. Seals: PTFE or EPDM-rubber O-rings.
      h. Handle: Tee shaped.

D. CPVC Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sloane, George Fischer, Inc.
      b. Spears Manufacturing Company.
   2. Description:
      a. Pressure Rating: 150 psig at 73 deg F.
      b. Body Material: CPVC.
      c. Body Design: Nonrising stem.
      d. End Connections for Valves NPS 2 and Smaller: Socket or Threaded.
      e. End Connections for Valves NPS 2-1/2 to NPS 4: Flanged.
      f. Gate and Stem: Plastic.
      g. Seals: EPDM rubber.
      h. Handle: Wheel.

2.7 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Manufacturing.
      b. Dresser, Inc.; Dresser Piping Specialties.
      c. Ford Meter Box Company, Inc. (The).
      d. JCM Industries.
      e. Romac Industries, Inc.
      f. Smith-Blair, Inc; a Sensus company.
      g. Viking Johnson; c/o Mueller Co.

D. Plastic-to-Metal Transition Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Charlotte Pipe and Foundry Company.
      b. Harvel Plastics, Inc.
      c. Spears Manufacturing Company.
   2. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 40 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Colonial Engineering, Inc.
      b. NIBCO INC.
      c. Spears Manufacturing Company.
   2. Description: CPVC or PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. EPCO Sales, Inc.
      d. Hart Industries International, Inc.
      e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      f. Zurn Plumbing Products Group; Wilkins Water Control Products.
   2. Description:
      a. Pressure Rating: 250 psig at 180 deg F.
      b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. EPCO Sales, Inc.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Factory-fabricated, bolted, companion-flange assembly.
      b. Pressure Rating: 300 psig.
      c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Calpico, Inc.
      b. Lochinvar Corporation.
   2. Description:
      a. Galvanized-steel coupling.
      b. Pressure Rating: 300 psig at 225 deg F.
      c. End Connections: Female threaded.
      d. Lining: Inert and noncorrosive, thermoplastic.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping per manufacturer’s recommendations.

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level without pitch and plumb.

E. Install seismic restraints on piping.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

J. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

K. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gauge. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.

J. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.

K. Steel-Piping Grooved Joints: Cut or roll groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service Chloramine resistant as stated above. Join flanges with gasket and bolts according to ASME B31.9.

M. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
   2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
   1. NPS 1-1/2 and Smaller: Fitting-type coupling.
   2. NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 FIELD QUALITY CONTROL

A. Piping Tests:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.8 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:
   1. Purge new piping before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

C. Above ground domestic water piping, NPS 2 and smaller, shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought- copper solder-joint fittings; and brazed soldered joints.
   2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
   3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper push-on-joint fittings; and push-on joints.
   4. CPVC, Schedule 40 pipe; CPVC, Schedule 40 Schedule 80 pipe; CPVC, Schedule 80 socket fittings; and solvent-cemented joints.
   5. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 and NPS 2 CPVC pipe with CPVC socket fittings may be used instead of tubing.

D. Above ground domestic water piping, NPS 2-1/2 to NPS 4 shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought- copper solder-joint fittings; and soldered joints.
   2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
   3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); grooved-joint copper-tube appurtenances; and grooved joints.
   4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
6. CPVC, Schedule 80 pipe; CPVC, Schedule 80 socket fittings; and solvent-cemented joints.

END OF SECTION

SECTION 221119
DOMESTIC WATER PIPING SPECIALTIES

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 domestic water piping specialties:
   1. Vacuum breakers.
   2. Strainers.
   3. Outlet boxes.
   4. Hose bibbs.
   5. Wall hydrants.
   6. Drain valves.
   7. Air vents.
   8. Trap-seal primer valves.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

B. This section covers variable speed domestic cold water and domestic hot water pressure booster systems.

1.4 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Arrowhead Brass Products, Inc.
      b. Cash Acme.
      c. Conbraco Industries, Inc.
      d. Legend Valve.
      e. MIFAB, Inc.
      f. Prier Products, Inc.
      g. Watts Industries, Inc.; Water Products Div.

h. Woodford Manufacturing Company.
i. Zurn Plumbing Products Group; Light Commercial Operation.
j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

B. Hose-Connection Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Conbraco Industries, Inc.
b. Watts Industries, Inc.; Water Products Div.
c. Woodford Manufacturing Company.
2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS ½ or NPS ¾.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

2.2 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller;flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
a. StrainersNPS 2 and Smaller: 0.020 inch.
b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Pipe plug.

2.3 OUTLET BOXES

A. Clothes Washer Outlet Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Guy Gray Manufacturing Co., Inc.
b. IPS Corporation.
c. LSP Products Group, Inc.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings shall complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS ½ gate, globe, or ball valves and NPS ½ copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.

2.4 HOSE BIBBS

A. Hose Bibbs:
   1. Standard: ASME A112.18.1 for sediment faucets.
   2. Body Material: Bronze.
   3. Seat: Bronze, replaceable.
   4. Supply Connections: NPS ½ or NPS ¾ threaded or solder-joint inlet.
   5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
   6. Pressure Rating: 125 psig.
   7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
   8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
   9. Finish for Service Areas: Rough bronze.
   10. Finish for Finished Rooms: Chrome or nickel plated.
   11. Operation for Equipment Rooms: Wheel handle or operating key.
   12. Operation for Service Areas: Operating key.
   13. Operation for Finished Rooms: Operating key.
   14. Include operating key with each operating-key hose bibb.
   15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.5 WALL HYDRANTS

A. Non-freeze Wall Hydrants:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. MIFAB, Inc.
      c. Prier Products, Inc.
      d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      e. Tyler Pipe; Wade Div.
      f. Watts Drainage Products Inc.
      g. Woodford Manufacturing Company.
      h. Zurn Plumbing Products Group; Light Commercial Operation.
      i. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
   3. Pressure Rating: 125 psig.
   4. Operation: Loose key.
   5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   6. Inlet: NPS ¾ or NPS 1.
   7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   8. Box: Deep, flush mounting with cover.
   9. Box and Cover Finish: Chrome plated.
   10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
   12. Operating Keys(s): One with each wall hydrant.

2.6 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. PPP Inc.
      b. Sioux Chief Manufacturing Company, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS ½ threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS ½ threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
   3. Do not install bypass piping around backflow preventers.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and pressure gauges.

D. Install water hammer arresters in water piping according to PDI-WH 201.

E. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

END OF SECTION

SECTION 221316
SANITARY WASTE AND PIPE VENTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:
1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, and details.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS MANUFACTURERS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. Fernco Inc.
d. Matco-Norca, Inc.
e. MIFAB, Inc.
f. AB&I Foundry.
g. Stant.
h. Tyler Pipe.
2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ANACO-Husky.
b. Clamp-All Corp.

c. Dallas Specialty & Mfg. Co.
d. MIFAB, Inc.
e. Mission Rubber Company; a division of MCP Industries, Inc.
f. Stant.
g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. MG Piping Products Company.
2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.2 ABS PIPE AND PVC PIPE FITTINGS.

2.3 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Capitol Manufacturing Company.
2) Central Plastics Company.
3) Hart Industries International, Inc.
4) Jomar International Ltd.
5) Matco-Norca, Inc.
6) McDonald, A. Y. Mfg. Co.
7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
8) Wilkins; a Zurn company.
b. Description:
1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

M. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
   1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
   2. Install drains in sanitary drainage gravity-flow piping.

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 221319
SANITARY WASTE PIPING SPECIALTIES

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 sanitary drainage piping specialties:
   1. Backwater valves.
   2. Cleanouts.
   3. Floor drains.
   4. Trench drains.
   5. Roof flashing assemblies.
   6. Through-penetration firestop assemblies.
   7. Miscellaneous sanitary drainage piping specialties.
   8. Flashing materials.

B. Related Sections include the following:
   1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, roof drains, and catch basins.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Tyler Pipe; Wade Div.
      d. Watts Drainage Products Inc.
      e. Zurn Plumbing Products Group.
   2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
   3. Size: Same as connected branch.
   4. Type: Heavy-duty, adjustable housing.
   5. Body or Ferrule: Cast iron.
   6. Clamping Device: Required.
   7. Outlet Connection: Threaded.
   8. Closure: Cast-iron plug.
   9. Adjustable Housing Material: Cast iron with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   11. Frame and Cover Shape: Round.
   12. Top Loading Classification: Extra Heavy Duty.
   13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.
   14. Standard: ASME A112.3.1.
   15. Size: Same as connected branch.
   16. Housing: Stainless steel.
   17. Closure: Stainless steel with seal.
   18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M. Include wall access.
   3. Size: Same as connected drainage piping.
   4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure: Countersunk or raised-head, drilled-and-threaded plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
   7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
   8. Wall Access: Round nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group.

2. Standard: ASME A112.6.3.
3. Pattern: Sanitary drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Funnel: Not required.
16. Inlet Fitting: Not required.
17. Trap Material: Cast iron.
18. Trap Pattern: Standard P-trap.
19. Trap Features: Trap-seal primer valve drain connection.

B. Stainless-Steel Floor Drains:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company; Blucher-Josam Div.
b. Josam Company; Josam Div.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Outlet: Bottom Side.
4. Top or Strainer Material: Stainless steel.
5. Top Shape: Square.
6. Seepage Flange: Required.
7. Anchor Flange: Required.
8. Clamping Device: Required.
9. Trap-Primer Connection: Required.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

2.4 TRENCH DRAINS

A. Trench Drains:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Not required.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Grate Material: Ductile iron or gray iron.

8. Grate Finish: Not required.
9. Top Loading Classification: Extra Heavy-Duty.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

2.5 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acorn Engineering Company; Elmdor/Stoneman Div.
      b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft, 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
   1. Open-Top Vent Cap: Without cap.
   2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
   3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:
   1. Manufacturers: Subject to compliance with requirements, provide product by the following:
      a. ProSet Systems Inc.
   2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
   3. Size: Same as connected soil, waste, or vent stack.
   4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
   5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
   6. Special Coating: Corrosion resistant on interior of fittings.

2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:
   1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
   2. Size: Same as connected waste piping.

B. Deep-Seal Traps:
   1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
   2. Size: Same as connected waste piping.
      a. NPS 2: 4-inch- minimum water seal.
      b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:
   1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   2. Body: Bronze or cast iron.
   3. Inlet: Opening in top of body.
   4. Outlet: Larger than inlet.
   5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:
   1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
   2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:
   1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
   2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:
   1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
   2. Size: Same as connected stack vent or vent stack.

H. Expansion Joints:
   1. Standard: ASME A112.21.2M.
   2. Body: Cast iron with bronze sleeve, packing, and gland.
   3. End Connections: Matching connected piping.
   4. Size: Same as connected soil, waste, or vent piping.

2.8 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
   2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
   3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Applications: 12 oz./sq. ft. thickness.
   2. Vent Pipe Flashing: 8 oz./sq. ft. thickness.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

I. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

J. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

K. Assemble open drain fittings and install with top of hub 2 inches above floor.

L. Install deep-seal traps on floor drains and other waste outlets, if indicated.

M. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

N. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

O. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

P. Install vent caps on each vent pipe passing through roof.

Q. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

R. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

S. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

T. Install drain trough (clothes washer) with cleanout immediately downstream from drain trough that do not have integral cleanout on outlet. Install trap on drain trough that do not have integral trap and are connected to sanitary drainage and vent systems.

U. Install wood-blocking reinforcement for wall-mounting-type specialties.

V. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
   2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 223448
ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes the following for domestic water systems:
   1. Point of use, electric water heaters.
   2. Commercial, electric water heaters.
   3. Compression tanks.
   4. Accessories.

1.2 RELATED WORK AND REQUIREMENTS

A. Requirements of General Conditions, Division 1.

B. Section, Commissioning.

1.3 SUBMITTALS

A. See Section 01334 – “Shop Drawings, Product Data and Samples”.

B. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

C. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

D. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.

E. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
   1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.

2. ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings," for household water heaters.

1.5 WARRANTY

A. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include heating elements and storage tanks.
   2. Warranty Period: From date of Substantial Completion:
      a. Heating Elements: three years.
      b. Storage Tanks: 3 year replacement warranty if tank leaks.
      c. 10 year limited warranty for hybrid heat pump electric water heaters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hybrid electric heat pump water heater:
      a. AO Smith
      b. Or equal
   2. Commercial, Point-of-Use, Small-Capacity, Electric Water Heaters:
      a. Chronomite
      b. Stiebel Eltron.
      c. Smith: A. O. Smith Water Products Co.
      d. Or equal.
   3. Commercial, Storage, Electric Water Heaters:
      a. Smith: A. O. Smith Water Products Co.
      b. Rheem Manufacturing Co.
   4. Compression Tanks:
      a. Amtrol, Inc.
      b. Taco, Inc.
      c. Wessels Co.
      d. Or equal.

2.2 COMMERCIAL, POINT-OF-USE, STORAGE, ELECTRIC WATER HEATERS

A. Description: Comply with UL 174 or UL 1453, and listed by manufacturer for commercial applications.

B. Storage Tank Construction: Non-ASME-code steel with 150-psig working-pressure rating.
   1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, drain, anode rod, and controls as required. Attach tappings to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
   2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
   3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
   4. Jacket: Steel, with enameled finish.

C. Heating Elements: Two, unless otherwise indicated; electric, screw-in, immersion type.
   1. Temperature Control: Adjustable thermostat.

D. Anode Rod: Factory installed, magnesium.

E. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

F. Special Requirement: NSF 5 construction.

2.3 COMMERCIAL, STORAGE, ELECTRIC WATER HEATERS

A. Description: Comply with UL 1453.
   1. Storage Tank Construction: Non-ASME-code steel with 150-psig working-pressure rating.
   2. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rods, and controls as required. Attach tappings to tank shell before testing and labeling.
      a. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.
   3. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
   4. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
   5. Jacket: Steel, with enameled finish.

B. Heating Elements: Electric, screw-in or bolt-on, immersion type arranged in multiples of three.
   1. Exception: Water heaters up to 9-kW input may have 2 or 3 elements.
   2. Staging: Input not exceeding 18 kW per step.
   3. Temperature Control: Adjustable, immersion thermostat.
   4. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

C. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

D. Anode Rods: Factory installed, magnesium.

E. Dip Tube: Factory installed. Not required if cold-water inlet is near bottom of storage tank.

F. Special Requirement: NSF 5 construction.

2.4 COMPRESSION TANKS

A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

B. Construction: 150-psig working-pressure rating.

C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.

D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

E. Tank Exterior Finish: Manufacturer's standard, unless finish is indicated.

F. Air-Charging Valve: Factory installed.

2.5 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.
   1. Option: Separate temperature and pressure relief valves are acceptable instead of combination relief valve.
   2. Exception: Omit combination temperature and pressure relief valve for tankless water heater, and furnish pressure relief valve for installation in piping.

B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than heat-exchanger working-pressure rating.

C. Vacuum Relief Valves: Comply with ASME PTC 25.3. Furnish for installation in piping.
   1. Exception: Omit if water heater has integral vacuum-relieving device.

D. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig- maximum outlet pressure.

E. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

F. Water Heater Stand and Drain Pan Units: High-density-polyethylene-plastic, 18-inch- high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1, pipe thread.

G. Water Heater Stands: Water heater manufacturer's factory-fabricated, steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.

H. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated, steel bracket for wall mounting and capable of supporting water heater and water.

I. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

J. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

K. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE 90.1 or ASHRAE 90.2.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters on:
   1. A stand, bracket, suspended platform, or direct on floor is indicated.

B. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Anchor water heaters to substrate.

D. Install seismic restraints for water heaters. Anchor to substrate.

E. Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

F. Install pressure relief valves in water piping for water heaters without storage. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

G. Install vacuum relief valves in cold-water-inlet piping.

H. Install vacuum relief valves in water heater storage tanks that have copper lining.

I. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 221119 Section "Plumbing Specialties" for drain valves.

J. Install thermometers on water heater inlet and outlet piping. Refer to Division 221119 Section "Piping Specialties" for thermometers.
   1. Exception: Omit thermometers for the following:
      a. Commercial, point-of-use, water heater inlet piping.
      b. Water heater with thermometer outlet piping.

K. Install pressure gauges on water heater piping. Refer to Division 221119 Section "Piping Specialties" for pressure gages.

L. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

M. Fill water heaters with water.

N. Charge compression tanks with air.

O. Additional installation requirements for Hybrid Heat pump electric water heater.
   1. Tank must be installed to manufacturer installation specifications.
   2. Unit must be level
      Condensate line must be drained via a sloped drainage system, a condensate pump, or connect to a plumbing drain.
   3. If unit is ducted:
      - All ducts must be sealed
      - Penetrations through the exterior of the home need to be sealed with an insulative sealant.
      - The exhaust air (conditioned air) duct from the heat pump water heater must be insulated to prevent condensation.
   4. Installation by a qualified technician.
   5. Hot and cold pipe must be insulated with a minimum of R-3, closed-cell, foam insulation for at least the first 3’ past the water heater and, if accessible, up to 6’ adjacent to the water heater.

Insulation material, jackets or facing, and adhesive (if used) must have a flame spread/smoke density rating in accordance with ASTM E-84.
Pipe insulation must not cover pressure relief valves, handles, safety drain valves or any other safety control device.
All pipe elbows and joints must be mitered to ensure coverage at the same thickness as straight runs.
Pipe insulation must be secured with twine, corrosion resistant wire, or plastic compression ties every 12 inches and within three inches of the ends.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.

D. Make connections with dielectric fittings where piping is made of dissimilar metal.

E. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.

F. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 COMMISSIONING

A. Engage a factory-authorized service representative to perform startup service.

B. In addition to manufacturer's written installation and startup checks, perform the following:
   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   2. Verify that piping system tests are complete.
   3. Check for piping connection leaks.
   4. Check for clear relief valve inlets, outlets, and drain piping.
   5. Check operation of circulators when specified.
   6. Test operation of safety controls, relief valves, and devices.
   7. Energize electric circuits.
   8. Adjust operating controls.
   9. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F unless piping system application requires higher temperature.

3.4 TRAINING

A. Engage a factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain water heaters.
   1. Train maintenance personnel on procedures for starting and stopping, troubleshooting, servicing, and maintaining equipment.
   2. Review data in maintenance manuals. Refer to Division 1.
   3. Schedule training with Owner’s Representative, with at least seven days' advance notice.

END OF SECTION

SECTION 224000
PLUMBING FIXTURES

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 conventional plumbing fixtures and related components:
   1. Faucets for lavatories, bathtubs, bathtub/showers, showers and sinks.
   2. Laminar-flow faucet-spout outlets.
   3. Toilet seats.
   4. Protective shielding guards.
   5. Fixture supports.
   6. Shower receptors.
   7. Water closets.
   8. Lavatories.
   9. Commercial sinks.
   10. Individual showers.
   11. Kitchen sinks.
   12. Service sinks.
   13. Owner-furnished fixtures.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. FRP: Fiberglass-reinforced plastic.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated.

B. Operation and Maintenance Data.

PART 2 - PRODUCTS

A. Plumbing fixtures are per the plumbing fixture schedule on Design Consultant drawings and architectural specifications.

B. The target for this project is to achieve LEED certified.

C. Plumbing fixtures shall be labeled “Water Sense” and selected for ultra-low flow.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install shower flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

S. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck. Connect inlet hose to dishwasher and outlet hose to disposer.

T. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.

U. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.2 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 230050
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Materials, equipment, fabrication, installation, starting, testing, and commissioning in conformance with applicable codes and authorities having jurisdiction for Mechanical Work covered by all sections within this Division including, but not limited to:

1. Heating, ventilating and air conditioning systems and equipment.

B. Related Sections

1. All work in every Section must also comply with such general conditions of the specifications as are applicable, including, but not limited to:
   a. Instructions to Bidders.
   b. General Conditions.
   c. Special Conditions.
   d. Supplementary Conditions.
   e. Division 1 – General Requirements Sections as specified hereinafter.

1.2 REFERENCE STANDARDS

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not.

C. Requirements of Regulatory Agencies.

1. In accordance with the requirements of Division 1 – General Requirements.
2. Nothing in contract documents shall be construed to permit work not conforming to current and applicable laws, ordinances, rules, and regulations.
3. When contract documents exceed requirements of applicable laws, ordinances, rules, and regulations, comply with documents establishing the more stringent requirement.
4. It is not the intent of contract documents to repeat requirements of codes except where necessary for completeness or clarity.
5. Seismic construction and restraints: In accordance with requirements of Title 17 of California Administrative Code.
6. Comply with the Safety Orders issued by California Occupational Safety and Health Act, COSHA and any other safety, health or environmental regulations of the State of California and any districts having jurisdictional authority. Where an

omission or conflict appears between COSHA requirements and the Drawings and Specifications, COSHA requirements shall take precedence.

7. Applicable codes as listed below, in addition to others specified in individual sections.
    a. CEC – California Electrical Code
    b. CBC – California Building Code
    c. CMC – California Mechanical Code
    d. CPC – California Plumbing Code
    e. City and County Codes and Amendments
    f. California Code of Regulations, including Titles 8, 17, 19, 20, 21, 22 and the California Building Standards Code Part 2, Basic Building Regulations.

D. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in Division 23 – Mechanical, in addition to other standards which may be specified in individual sections.

E. All base material shall meet ASTM and ANSI standards.

F. All Gas Fired Devices: Comply with standards and bear label of AGA.

G. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped.

H. All Electrical Devices and Wiring

1. Conform to standards of CEC/NEC
2. All devices UL or ETL listed and identified.

I. Guidelines and Standards: The latest edition of guidelines and standards published by the following groups will govern the Mechanical Systems and associated support system design. The systems shall be designed to meet or exceed these guidelines and standards.

1. AABC – Associated Air Balance Council
2. ADC – Air Diffuser Balance Council
3. AFBMA – Anti-Friction Bearing Manufacturer's Association
4. AGA – American Gas Association
5. AMCA – Air Movement and Control Association, Inc.
6. ANSI – American National Standards Institute
7. ARI – Air Conditioning and Refrigeration Institute
8. ASC – Adhesive and Sealant Council
9. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers
10. ASME – American Society of Mechanical Engineers
11. ASSE – American Society of Sanitary Engineering
12. ASTM – American Society for Testing and Materials
13. AWWA – American Water Works Association
14. AWS – American Welding Society
15. COSHA – California Occupational Safety and Health Act
16. ETL – Intertek Semko (Formerly Electrical Testing Laboratories)

17. General Industry Safety Orders
18. Hydraulic Institute
19. ICBO – International Conference of Building Officials
20. IEEE – Institute of Electrical and Electronic Engineers
21. NBS – National Bureau of Standards
22. NEBB – National Environmental Balancing Bureau
23. NEC – National Electric Code
24. NEMA – National Electrical Manufacturer's Association
25. NFPA – National Fire Protection Association
26. OSHPD – Office of Statewide Health Planning and Development
27. PDI – Plumbing and Drainage Institute
28. SFA – California State and Local Fire Marshall
29. SMACNA – Sheet Metal and Air Conditioning Contractors National Association, Inc.
30. UL – Underwriters' Laboratories, Inc.

J. Insurance requirements

1. Provide entire fire protection system, including equipment, materials and services listed in accordance with the Owner's Insurance Underwriters' requirements.
   a. Specifications and drawings
   b. Requirements of local authority having jurisdiction
2. Obtain approval for fire protection system prior to the start of installation
   a. Approval means submittal to and acceptance by
      1) Owner's insurance underwriter
      2) Local authority having jurisdiction
   b. Provide verification of this approval to the Owner’s Representative
3. Nothing in specifications or drawings shall be construed as permitted deviation from requirements specified above.

1.3 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed in Paragraph 1.1C and with all applicable national, state and local codes.

B. All equipment and accessories shall be new and the product of a manufacturer regularly engaged in its manufacture.

C. All items of a given type shall be the products of same manufacturer.

D. All work in Division 23 – Mechanical shall be commissioned per the relevant pre-functional tests, Section 23 0800 – Commissioning of HVAC.

1.4 SUBMITTALS

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformity with the design intent and the Contractor has responded to all comments to the satisfaction of the Owner’s Representative.

B. Submit drawings, product data, samples, and certificates of compliance required as hereinafter specified. See also Division 1 – Shop Drawings, Product Data, and

Samples. Conditions in this Section take precedence over conditions in the above-referenced Section.

C. Submit no later than 35 days after signing of Contract, or as otherwise indicated by Owner's Representative.

1. Complete schedule of submittals for equipment and layout shop drawings. Allow 15-working days for review unless the Owner's Representative agrees to accelerated schedule.
2. List of all proposed substitutions: See Paragraph 1.6
3. Designate schedule dates for submission and dates that reviewed shop drawings, product data and samples will be needed.
4. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.

D. Submission and Resubmission Procedure

1. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as "SUBMITTAL 23 xxxx-01"
2. Each resubmittal shall have the original unique serial number plus unique revision number such as "SUBMITTAL 23 xxxx-01 REVISION 1"
3. Submit in format specified below. Submissions made in the wrong format will be returned without action.
    a. Product Submittals: One copy in electronic format per Paragraph 1.5A.4.c.
    b. Shop Drawings:
        1) One copy in electronic format .dwg, .dwf, .pdf or .tif
        2) Two and only two copies on paper; any additional copies will be returned without review.
    c. Samples: As indicated in each specification section
4. Owner's Representative will return a memo or mark-up of submittal with comments and corrections noted where required.
5. Make corrections
    a. Revise the initial submittal to resolve review comments and corrections.
    b. Indicate any changes that have been made other than those requested.
    c. Clearly identify resubmittal by original submittal number and revision number
6. Resubmit revised submittals until no exceptions are taken.
7. Once submittals are accepted and stamped with no exceptions taken, Contractor shall make photocopies for coordination with other trades, as required by the General Contractor. Photocopies will serve as submittal for record and coordination.

E. Product Data Submittals

1. Contents
    a. Manufacturer's name and model number
    b. All information required to describe materials and equipment completely and to indicate compliance with drawings and specifications, including, but not limited to:
        1) Schedule when more than one of each item is covered by the submittal.
        2) Physical data, as applicable

a) Dimensions
b) Weight
c) Finishes and colors
d) Dimensional shop drawings

3) Performance data, as applicable
a) Rated capacities
b) Performance curve
c) Operating temperature and pressure

4) Flow and wiring diagrams as applicable
5) Description of system operation

c. All other pertinent information requested in individual sections

2. Format
a. See Division 1 – Shop Drawings, Product Data, and Samples
b. Identify clearly if submittal is substitution: Refer to Paragraph 1.6
c. Reference specification Division, Section, Title, Paragraph, and Page number or drawing number as applicable.
d. Use the same nomenclature, legend, symbols, and abbreviations on submittal material as used in contract documents.

F. Layout Shop Drawings. Not required.

G. Layout Shop Drawings

1. Drawings shall be developed in a format compatible with AutoCAD version 2005 or later.
2. Shop fabrication, coordination, and installation drawings by the Contractor are for the Contractor's use and shall be the Contractor's responsibility. These Drawings indicate where the Contractor intends to install the material and equipment as required by the Contract Documents. Do not submit shop fabrication documents unless requested. Use of contract documents or electronic files of contract documents for shop drawings is not sufficient.
3. Prepare and submit Shop Drawings for all Work deviating from that indicated on Contract Drawings. Clearly indicate deviations.
4. Review is not intended to verify dimensions or quantities, or to coordinate items shown on these Drawings. The review is for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of Work with that of all other trades and the satisfactory performance of Work.
5. Prepare and submit layout drawings, sections and details for following areas, minimum 1/4 inch scale:
a. Mechanical rooms
6. Prepare layout shop drawings for all areas; minimum 3/8 inch scale.
7. Layout drawings, as a requirement of Division 23 Mechanical, shall indicate, superimposed, Work of all Sections involved in congested area, including ductwork, piping, electrical work, ceiling work, etc. Include all mechanical rooms. Identification of space problems without solutions is not acceptable.
8. Individual coordinated trade layout drawings are to be prepared for all deviations from design documents.

9. Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.
    a. Include stamp on each submittal indicating that layout shop drawing has been coordinated:
    b. No layout shop drawing will be reviewed without a stamped and signed coordinated assurance by the Contractor.
10. All changes shall be clearly marked on each submitted layout drawing.
11. Drawings shall show work of all trades, including but not limited to:
    a. Ductwork
    b. Piping: All Trades
    c. Mechanical Equipment
        1) For fire and smoke dampers, tag each damper with a unique tag, starting with the tag on the drawings, but adding a 4-digit number: xyzz where
            a) x= AC or AH unit that serves the damper
            b) y= floor
            c) zz= unique consecutive number
    d. Electrical Equipment
    e. Main Electrical conduits and bus ducts
    f. Equipment supports and suspension devices
    g. Structural and architectural constraints
    h. Show location of
        1) Valves: manual and automatic
        2) Piping specialties
        3) Dampers: fire/smoke, automatic and manual volume, etc.
        4) Access doors
        5) Control and electrical panels
        6) Others as required for clear coordination.
12. Drawings shall indicate coordination with work specified in other Divisions, which must be coordinated with work specified under Division 23 Mechanical, including, but not limited to:
    a. Irrigation equipment and piping
    b. Elevator equipment
    c. Building vacuum cleaning systems
    d. Cable trays
    e. Computer equipment
    f. Others as required.
13. Submission of drawings
    a. See Division 1 – Shop Drawings, Product Data and Samples
    b. Submit to other trades for review of space allocated to all trades
    c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades
    d. Ensure that each trade has coordinated work with other trades
    e. Submit with stamps of General and all other applicable Contractors, initialed and signed certifying
        1) Review of submittal
        2) Verification of products, field measurements and field construction criteria
        3) Coordination of information in submittal with requirements of work of this Division and other divisions of Contract Documents

f. No layout shop drawing will be reviewed without stamped and signed coordination assurance by the Contractor

H. Samples

1. Submit as required in each specification section

I. Tables of Submittals Required

1. Submit layout shop drawings, product data, or samples according to the following table
2. “R” in Submittal Data Column indicates submittal for Owner’s Representative’s review
3. “R” in Layout Shop Drawings Column indicates item shall be included in shop drawings for Owner’s Representative’s review
4. “R2” indicates submittal for Owner’s Representative’s review for products and equipment differing for the specified manufacturer and model and for “or equals” where specified
5. “M” indicates submittal shall be included in service and maintenance and shall be included as part of O&M Manual
6. Refer to individual Sections within Division 23 – Mechanical for additional submittal requirements.

ITEM		LAYOUT SHOP DRAWINGS	SUBMITTAL REQUIRED	
			DATA	SAMPLES
230513	MOTORS AND CONTROLLERS			
	MOTORS		R2, M	
	BELTS AND DRIVES		R2, M	
	VARIABLE SPEED DRIVES	R	R, M	
230529	HANGERS AND SUPPORTS			
	PIPE HANGERS AND SUPPORTS		R2	
	STRUCTURAL ATTACHMENTS		R2	
	PIPE PROTECTION AND THERMAL HANGER SHIELDS		R2	
	EXPANSION SHIELDS		R2	
230548	MECHANICAL SOUND, VIBRATION AND SEISMIC CONTROL			
	CONCRETE AND STEEL DETAILS FOR EQUIPMENT PADS.	R		
	VIBRATION ISOLATION DEVICES: CATALOG CUTS, ISOLATION EFFICIENCIES AND RATED STATIC DEFLECTIONS.		R, M	

ITEM		LAYOUT SHOP DRAWINGS	SUBMITTAL REQUIRED	
			DATA	SAMPLES
	WELDS OR ANCHOR BOLT LOCATIONS.	R		
	REINFORCING AND TEMPLATE STEELS.	R		
	NUMBER AND LOCATION OF SEISMIC RESTRAINTS FOR EACH EQUIPMENT; SPECIFIC DETAILS OF RESTRAINTS INCLUDING ANCHOR BOLTS FOR MOUNTINGS AND MAXIMUM LOAD AT EACH LOCATION.		R	
	SPRING O. D., FREE, OPERATING AND SOLID HEIGHTS OF SPRINGS AND RATIO OF HORIZONTAL TO VERTICAL STIFFNESS.		R	
	NUMBER AND LOCATION OF VIBRATION ISOLATORS FOR EACH EQUIPMENT INCLUDING ACTUAL OPERATING LOAD FOR EACH VIBRATION ISOLATOR.	R	R	
	SEISMIC CALCULATIONS FOR EACH SEISMIC RESTRAINT SIZED AND SIGNED BY REGISTERED STRUCTURAL OR CIVIL ENGINEER.		R	
	EQUIPMENT BASES AND PADS	R	R	
	ANCHOR, INSERT AND FASTENER BOLT FASTENING DETAILS	R		
	ANCHORS, INSERTS AND FASTENERS		R2	
	SEISMIC RESTRAINTS		R2	
	SEISMIC BRACING AND RESTRAINT MOUNTING DETAILS		R	
	FLEXIBLE DUCT CONNECTORS	R	R2	
230553	MECHANICAL IDENTIFICATION			
	PIPING IDENTIFICATION CHARTS		R	
	VALVE TAGS		R	
	PIPE MARKERS		R2	
	EQUIPMENT TAGS		R2	
230700	MECHANICAL INSULATION			
	EQUIPMENT INSULATION		R	

ITEM		LAYOUT SHOP DRAWINGS	SUBMITTAL REQUIRED	
			DATA	SAMPLES
	PIPING INSULATION		R	
	JACKETS		R	
	DUCT INSULATION, WRAP AND LINER		R	
	ADHESIVES AND COATINGS		R2	
	MECHANICAL FASTENERS		R2	
233112	DUCTS			
	DUCTWORK, GALVANIZED, ROUND AND RECTANGULAR	R	R2	
	FLEXIBLE DUCTS		R2	
	DUCT SEALANTS		R2	
	FITTINGS		R2	
	DUCT PRESSURE TESTING REPORTS		R, M	
233300	DUCT ACCESSORIES			
	ACCESS DOORS	R	R2	
	MULTIBLADE VOLUME DAMPERS	R	R2	
	BACKDRAFT DAMPERS	R	R2	
	FIRE DAMPERS	R	R, M	
	SMOKE AND COMBINATION DAMPERS	R	R, M	
	CONTROL DAMPERS	R	R	
233415	FANS			
	FANS	R	R, M	
	FAN ACCESSORIES		R, M	
238219	FAN COIL UNITS			
233713	AIR OUTLETS AND INLETS	R	R, M	
234100	AIR CLEANING DEVICES			
	FILTERS	R	R2, M	
	FILTER GAUGES	R	R2, M	
230593	TESTING, ADJUSTING AND BALANCING			
	AIR BALANCING REPORT		R, M	R
230800	HVAC COMMISSIONING			

ITEM		LAYOUT SHOP DRAWINGS	SUBMITTAL REQUIRED	
			DATA	SAMPLES
	PRE-FUNCTIONAL TEST REPORTS		R, M	R
	FUNCTIONAL TEST REPORTS		R, M	R
	FINAL COMMISSIONING REPORT		R, M	
	TRAINING MATERIALS		R, M	

1.5 COMPLETION REQUIREMENTS

A. Procedure

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted.”
2. Before requesting acceptance of work, submit one set of Completion Documents for review and approval of Owner’s Representative
3. After review, furnish quantity of sets indicated below to Owner.
4. Format
   a. See Paragraph 1.5H for required format of Completion Documents
   b. Paper copies; assemble in chronological order following alpha-numeric system used in specification, in heavy three-ring binder
   c. Where electronic copies are called for in Paragraph 1.5H, comply with the following:
      1) Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf) and HTML; submit other formats for review and approval prior to submission; scanned paper documents not acceptable
      2) For submittals, provide separate file for each type of equipment
      3) For Test & Balance report, provide separate files for each air handling system
      4) Record drawings shall be in original format per paragraph 1.4G.1

B. Operating and Maintenance (O&M) Manual

1. In accordance with requirements of Division 1 – Operating and Maintenance and as follows.
2. O&M Manual shall include but is not limited to the following:
   a. Complete Product Data Submittals per Paragraph 1.4E so that the details of the device are known.
   b. Manufacturer's name, model number, service manual, spare-parts list and descriptive literature for all components
   c. Operating instructions
   d. Maintenance and repair requirements
   e. Wiring diagrams
   f. Requirements for special tools, test kits and calibration instructions
   g. Replacement parts list
   h. Valve tag directory

i. Name, address and phone number of contractor's equipment suppliers and service agencies

C. Record Drawings

1. Keep up to date during progress of job one set of Mechanical Drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base lines.
   a. Fully illustrate all revisions made by all crafts in course of work.
   b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders
   c. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents and piping drains
   d. Exact size, invert elevations and location of underground and under floor piping and ducts
2. Progress drawing set shall be available for inspection by Owner's Representative weekly
3. Update engineering design drawings and shop drawings to reflect revisions and additional data listed above at completion of Project
   a. Original engineering design drawings will be provided to Contactor in electronic format compatible with AutoCAD version 2005 or later
   b. Both shop and engineering design drawings shall be in format compatible with AutoCAD version 2005 or later
   c. Drawings required to be updated if revisions were made
      1) Floor plans
      2) Shop drawings required by Paragraph 1.4F
      3) Sections
      4) Riser diagrams

D. Test and Balance Reports

1. See Section 23 0593 – Testing, Adjusting and Balancing

E. Commissioning Reports

1. See Section 23 0800 – Commissioning of HVAC

F. Training Materials

1. See Section 23 0800 – Commissioning of HVAC

G. Miscellaneous Certificates

1. Pressure and Leakage Test documentation/certificates
2. Training/Instruction completion certificates
3. Fire Marshal and Fire Department approvals of system, as required
4. Final inspection certificate signed by governing authorities
5. Warranty period, including start and end period
6. Field test report, including as applicable
   a. Start up documents with date and name of technician
   b. Piping pressure tests

c. Flex coupled pump alignment verification
d. Duct leakage and pressure tests
e. Drain pan drainage tests
f. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures
g. Machinery vibration test reports
h. Certificates of sterilization/chlorination of plumbing systems
i. Others as specified herein and in other Division 23 – Mechanical sections

H. Format of Completion Documents

1. Provide the type and quantity of media listed in table below:

	Document	Paper (binder or bound)	Electronic	
			Read only optical disk	Loaded onto Operator Workstation
1.	O&M Manuals	3	1	1
2.	Record Drawings	2 Full size 2 Half size	1	1
3.	Test and Balance Report	5	1	–
4.	Commissioning Reports	5	1	–
5.	Miscellaneous Certificates	1	1	–
6.	Warranty documents	1	1	–
7.	Training materials	1 per trainee	1	1

1.6 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Contractor's Options.

1. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
2. For products specified by naming one product or manufacturer, submit request for substitutions for any product or manufacturer which is not specifically named in accordance with substitutions clause.
3. Wherever catalog numbers and specific brands or trade names are used, they are used to establish standards of quality, utility and appearance required.

1.7 DESCRIPTION OF BID DOCUMENTS

A. Specifications

1. Specifications, in general, describe the quality and character of materials and equipment.
2. Specifications are of simplified form and include incomplete sentences.
3. Words or phrases such as "The Contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" have often been omitted for brevity.

B. Drawings

1. Drawings in general are diagrammatic. Intention is to show size, capacity, approximate location, direction, and general relationship of one work phase to another, but not exact detail or arrangement.
2. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions where noted. Duct and piping elevations are indicated for initial coordination; final requirements shall be determined by the Contractor after final coordination with other trades.
3. Before proceeding with work check and verify all dimensions in the field.
4. Assume all responsibility for fitting materials and equipment to other parts of equipment and structure.
5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom and avoid architectural openings, structural members and work of other trades.
6. For exact locations of building elements, refer to dimensional Architectural and Structural drawings.

C. Do not use equipment exceeding dimensions indicated on drawings or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

D. If any part of Specifications or Drawings appears unclear or contradictory, apply to Owner's Representative for an interpretation and decision as early as possible.

1. Do not proceed with work without the decision of the Owner's Representative.

1.8 ALTERNATES

A. Refer to Division 1 – Alternates for possible effect on this Section

1.9 DEFINITIONS

A. Definitions of term used in Division 23 – Mechanical may differ from those given in general and supplementary conditions and take precedence over them.

B. "Provide": to furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

C. "Supply": to purchase, procure, acquire, and deliver complete with related accessories.

D. "Work": labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

E. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

F. "Wiring": raceway, fittings, wire, boxes, and related items.

G. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions, above hung ceilings, in trenches, in crawl spaces, or in enclosures.

H. "Exposed": not installed underground or "concealed" as defined above.

I. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or specifications.

J. "Reviewed," "approved," or "directed": as reviewed, approved, or directed by or to Owner's Representative.

K. "Motor Controllers": starters, variable speed drives, and other devices controlling the operation of motors.

L. "Control or Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

1.10 PROJECT CONDITIONS

A. Examine site related work and surfaces before starting work of any Section

1. In case of conflict, the most stringent takes precedence
2. For purposes of clarity and legibility, Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure and not shown. Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.
3. Exact routing of piping, ductwork, etc. shall be governed by structural conditions, obstructions. Not all offsets in ductwork or piping are shown on the Mechanical Drawings. Determine which item to offset or relocate. Maintain required slope in piping. Make use of data in Contract Documents. In addition, the Owner's Representative reserves right, at no additional cost to the Owner, to make any reasonable change in location of mechanical items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Verify Owner's Representative's requirements in this regard prior to rough-in.
4. Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult Architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the approximate location shown on mechanical Drawings.
5. Mounting heights of brackets, outlets, etc., as required
6. Report to Owner's Representative, in writing, conditions which will prevent proper provision of this work.
7. Beginning work of any Section without reporting unsuitable conditions to Owner's Representative constitutes acceptance of conditions by Contractor.
8. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to the Owner.

B. Coordination

1. Work out all "tight" conditions involving Work specified under this Division and Work in other Divisions in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no additional cost to the Owner.
2. Conflicts: Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided as follows:

    a. Install mechanical and electrical systems in the following order of preference (those trades listed below another must reroute to resolve the conflict):
        1) Drain piping required by code to be sloped
        2) Supply air and exhaust air ductwork connected to fans
        3) Electrical conduit 4 inches and larger
        4) Hydronic piping connected to pumps
        5) Domestic water piping
        6) Fire sprinkler piping
        7) Electrical conduit smaller than 4 inches
        8) Sprinkler piping
        9) Transfer ducts and other ductwork not connected to fans
        10) Control system piping and wiring
    b. Continued disputes shall be decided by Contractor and Contractor’s decision, if consistent with Contract Document requirements, shall be final.
3. Supervision: Personally, or through an authorized and competent representative, constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.
4. Provide templates, information, and instructions to other Divisions to properly locate holes and openings to be cut or provided.
5. The drawings govern matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Bid. No additional allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the Bid.

C. Equipment Rough-In

1. Rough-in locations shown on Mechanical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from the following sources.

    a. From Shop Drawings for equipment provided under this contract
    b. From Owner’s Representative for Owner furnished, Contractor installed equipment.
    c. From existing equipment where such equipment is relocated under this Contract

2. Verify mechanical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain

clarification from Owner’s Representative and provide as directed by the Owner’s Representative at no additional cost to the Owner.

3. Make final connections.

1.11 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping or ductwork

1. Prohibited, except as noted, in
   a. Electric rooms and closets over equipment, as restricted by CEC
   b. Telephone rooms and closets
   c. Elevator machine rooms
   d. Electric switchboard room
2. Prohibited, except as noted, over or within 5 feet of
   a. Transformers
   b. Substations
   c. Switchboards
   d. Motor control centers
   e. Standby power plant
   f. Bus ducts
   g. Electrical panels

1.12 PRODUCT DELIVERY, HANDLING AND STORAGE

A. See Division 1 Product Requirements

B. Deliver equipment in its original package to prevent damage or entrance of foreign matter. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Provide protective coverings during construction.

C. Handle and ship in accordance with manufacturer's recommendations

D. Identify materials and equipment delivered to Site to permit check against approved materials list, reviewed with no exceptions taken Shop Drawings

E. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no additional cost to the Owner.

F. Where necessary, ship in crated sections of size to permit passing through available space.

1.13 PROJECT MANAGEMENT AND COORDINATION SERVICES

A. See Division 1 – Project Coordination

B. Overview: Provide a project manager/engineer for the duration of the Project to coordinate the Division 23 – Mechanical work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.

C. Review of shop drawings prepared by other subcontractors.

1. Obtain copies of all shop drawings for equipment provided by others that require electrical service connections or interface with Division 23 – Mechanical work.
2. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 23 – Mechanical contract documents. Document any discrepancy or deviation as follows:
    a. Prepare memo summarizing the discrepancy.
    b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.
3. Prepare and maintain a shop drawing review log indicating the following information.
    a. Shop drawing number and brief description of the system/material
    b. Date of your review
    c. Indication if follow-up coordination is required.

D. Request for information (RFI)

1. See Division 1 Request for Information

1.14 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by the Owner’s Representative

B. Advise Owner’s Representative that work is ready for review at following times:

1. Prior to backfilling buried work.
2. Prior to concealment of work in walls and above ceilings.
3. When all requirements of Contract have been complete.

C. Neither backfill nor conceal work without Owner’s Representative’s consent.

D. Maintain on job set of Specifications and Drawings for use by Owner’s Representative's.

1. Include all change orders.

E. Contractor is responsible for construction methods, sequences, and safety precautions.

1.15 SCHEDULE OF WORK

A. In accordance with Division 1 – Contract Schedules and as follows:

1. Arrange work to conform to schedule of construction established or required to comply with Contract Documents
2. In scheduling, anticipate means of installing equipment through available openings in structure.

B. Confirm in writing to Owner’s Representative, within 35-days of signing of contract, anticipated number of days required to perform test, balance, acceptance testing and commissioning of mechanical systems. Schedule test, balance and acceptance testing of mechanical systems as follows:

1. Submit for review at this time, names and qualifications of test and balancing agencies to be used.
2. Test & Balance and commissioning must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
3. Allow 21-days after test and balance for system commissioning and life safety testing (where applicable)
4. Complete and test all systems early enough to enable completion of commissioning prior to Owner move-in.
5. Provide post construction purge direction immediately before occupancy.

1.16 CUTTING AND PATCHING

A. See Division 1 – Cutting, Patching and Matching

1.17 UTILITY CONNECTIONS

A. See Paragraph 1.1C.1

B. Connection to utility company mains

C. Connection to on-site piping mains

D. Payment of service charges

E. Provisions for temporary utilities

F. (Others as required)

1.18 WARRANTY

A. In accordance with Division 1 – Guarantees, Warranties, Bonds, Service & Maintenance Contracts and as follows.

B. Warranty all materials, equipment, apparatus and workmanship to be free of defective materials and faulty workmanship for period of one year from date of filing of Notice of Completion or upon beneficial use, at the direction of the Owner's Representative, see Paragraph 3.5A.1

C. Provide new materials, equipment, apparatus, and labor to replace that determined by Owner's Representative to be defective or faulty.

D. This guarantee also applies to services including instructions, adjusting, testing, noise, balancing, etc.

E. Furnish Manufacturers' standard Warranties in excess of one year.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Alternate manufacturers as identified in each section will be considered under conditions specified in Paragraph 1.6 of this section.

B. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials and equipment from Site.

C. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

D. Where no specific make of material or equipment is mentioned, any first class product of a reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance.

E. Provide an authorized representative to constantly supervise work of this Division, check all materials prior to installation for conformance with Drawings, Specifications, reviewed Submittals and reviewed Shop Drawings.

F. Conform to conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Owner’s Representative of conflicts in writing.

G. Material and Equipment-General Requirements

1. New.
2. Approved for use by State Fire Marshal and local building inspection department when applicable.
3. Testing agency labeled or with other identification wherever standards have been established.
4. Owner’s Representative reserves right to reject items not in accordance with Specification either before or after installation.
5. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design.
6. Compatible with space allocated; modifications necessary to adjust items to space limitations at Contractor's expense.
7. Installed fully operating and without objectionable noise or vibration.
8. Design of mechanical systems is generally based on product of the first named manufacturers cited. Where systems for product installed necessitate modification of systems shown on drawings, Contractor is responsible for installation of systems appropriate to product installed.

H. Electrical Requirements.

1. Electrical Work performed under Division 23 – Mechanical shall conform to requirements of Division 26 Electrical
2. Provide weatherproof devices and installation for out-of-doors work.

PART 3 – EXECUTION

3.1 INSPECTION

A. Verify that conditions are satisfactory for the installation of materials and equipment. Notify Owner’s Representative if conditions are not satisfactory and do not commence work until conditions have been corrected.

3.2 INSTALLATION

A. Install materials and equipment in compliance with governing codes.

B. Use printed descriptions, specifications, and recommendations of manufacturers as a guide for installation of Work. Follow in all cases where manufacturers of articles used furnish directions covering points not specified or shown.

C. Equipment

1. See Division 1 – Supporting from Building Structure.
2. Assemble equipment which is required to be field assembled under the direct supervision of the manufacturers' agent.
3. Prior to the final acceptance submit letters from the manufacturers that equipment has been assembled under the direct supervision of the manufacturers' agent.
4. Accurately set and level equipment with supports neatly placed and properly fastened.
5. Properly fasten equipment in place with bolts to prevent movement in earthquake.
6. Coordinate the installation of equipment with openings in structure.
7. Coordinate and fully dimension steel supports for mechanical equipment where shown on drawings with installing contractor.
8. Provide all roof curbs for roof mounted fans, flues, piping and duct penetrations, etc.

D. Electrical

1. See Division 26 Electrical.
2. Install electrical devices with code required clearances and access.
3. Assist the electrical contractor in the proper connecting of all electrical wiring and equipment required for mechanical equipment.

E. Sleeves, Chases and Concrete Inserts.

1. Provide all required sleeves, chases, concrete inserts, anchor bolts, etc.
2. Sleeves and chases are prohibited in structural members, except where shown or as directed by Owner’s Representative in writing.
3. Embed no piping in concrete or masonry.

F. Waterproof Construction

1. Comply with Division 7 – Thermal and Moisture Protection

2. Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of mechanical penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls.
3. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight.
4. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rainwater; this requirement applies to damper operators and bearing, damper motors, controls, and instruments; see other Sections in this Division for application of this requirement to motors, drive, ducts and fans.

G. Restoration of Damage

1. Repair or replace, as directed by Owner's Representative, materials and parts of premises which become damaged.
2. Remove replaced parts from premises at no additional cost to the Owner.

H. Review architectural drawings and coordinate with Architect and other contractors to be sure that all architectural shafts, plenums, rated duct enclosures etc. required for mechanical systems are properly located and dimensioned.

I. Access Panels and Doors

1. Product specified under Structural and Architectural disciplines specifications.:
   a. Coordinate size requirements and exact location with Contractor who will provide and install access doors.
   b. Minimum Sizes: 18 inches by 18 inches unless otherwise shown on Drawings or approved by Owner's Representative.
2. Provide where shown, or required by Regulatory Agencies, for access of all concealed equipment such as terminal units, valves, fire/smoke dampers, etc., for Mechanical Work:
   a. Equipment shall be located wherever practical over accessible ceilings or rooms to avoid access doors.
   b. Access doors shall not be used solely for access to balancing dampers; use instead remote-control devices specified under Section 23 3300 – Duct Accessories.

J. Openings

1. Coordinate and fully dimension all openings in walls, floors, roofs and structural elements required for mechanical work.
2. Provide all required fire-stopping around pipe, duct and other penetrations required for mechanical work in rated partitions where required by code.
3. Fire damper openings: Contractor shall provide damper UL installation requirements to contractor installing partitions to ensure construction complies with listing.
4. Air outlet openings:
   a. Contractor shall coordinate exact locations of air outlets in floors, walls and ceilings with contractor installing partition.

b. Contractor shall coordinate additional T-bar or spline required to accept air outlets with contractor providing and installing ceiling and associated materials.

3.3 PROTECTION OF MATERIALS

A. See Division 1 – Product Requirements.

B. Completely cover motors and other moving machinery to protect from dirt and water during construction.

C. Cap all openings in pipe and ductwork daily to protect against entry by foreign matter.

D. Material, equipment, or apparatus damaged because of improper storage or protection will be rejected.

1. Remove from site and provide new, duplicate, material, equipment, or apparatus in replacement of that rejected.
2. Any porous materials, such as duct liner or flexible ductwork that becomes wet; for example, due to rain shall be replaced; drying is not sufficient (due to possible microbial contamination).

E. Perform Work in manner precluding unnecessary fire hazard.

3.4 ADJUSTMENT

A. Preliminary Operation:

1. Operate any portion of installation for Owner's convenience if so requested by Owner’s Representative. Such an operation does not constitute acceptance of Work as complete but does constitute beneficial use, see Paragraph 1.18B. Cost of utilities, such as gas and electrical power, will be borne by the Owner if operation is requested by Owner’s Representative.

B. Startup Service

1. Prior to startup, ensure that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves. See pre-function tests in Division 23 – Mechanical.
2. Start and operate all systems.
3. Provide services of factory trained technicians for startup of major equipment and systems including boilers, fire pumps, etc.
4. Adjusting: See Section 23 0593 – Testing, Adjusting and Balancing
5. Life Safety Testing
    c. Assist Division 26 Electrical contractor in testing fire alarm controls, including control of smoke dampers and shut-off of fan systems.
    d. Correct any problems related to equipment supplied under Division 23 – Mechanical.
    e. Complete the control matrix with details such as fan tags, FSD tags, etc. based on control matrix provided with Life Safety Report.

f. Assist Life Safety System commissioning agent in testing and commissioning Life Safety System.
g. Provide all tests, air balance and start-up personnel required to start and commissioning the system and for assisting the design/construct team in demonstrating system compliance with the local fire district and building department.

C. Noise

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances.
2. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no additional cost to the Owner.

3.5 SPECIAL TOOLS

A. Furnish to Owner at completion of work.

1. One set of any special tools required to operate, adjust, dismantle, or repair equipment furnished under any section of this Division.
2. Pressure gauge and temperature sensor for piping test plug.

3.6 CLEANING

A. Cleaning

1. See Division 1 – Closeout Procedures, Final Cleaning and Extra Material.

B. Thoroughly clean equipment, fans, pumps, motors, piping and other materials under this Division free from all rust, scale and all other dirt before any covering or painting is done, or the systems put in operation; leave in condition satisfactory to Owner's Representative.

C. At all times keep the premises free from accumulation of waste material and debris caused by his employees. At the completion of the Project, and at other times as Owner's Representative may direct, remove refuse from within and around the building. All tools, scaffolding and surplus materials shall also be removed, leaving the Site of his Work clean.

D. Completely cover all plumbing fixtures and all motors and other moving machinery to prevent entry of dirt and water during construction.

E. Effectively cap all openings into ducts and pipes to keep moisture and foreign matter out during construction.

3.7 PAINTING

A. Cleaning

1. See Division 1 – Closeout Procedures, Final Cleaning and Extra Material.

B. Painting

1. Piping exposed to outdoors
   a. One coat primer.
   b. Two coat alkyd oil paint, UV resistant for PVC piping, color as indicated.
   c. Not required for copper, galvanized steel, or insulated piping.
2. Steel hangers and supports exposed to outdoors.
   a. One coat primer.
   b. Not required for galvanized steel.
3. Interior of ductwork and duct accessories, including insulation stick pins, at air outlets as far back as visible from occupied spaces.
   a. Flat black.
4. Marred surfaces of factory painted equipment.
   a. Spot coat to match the adjacent coat.
5. Insulation exposed to sunlight: See Section 23 0700 – HVAC Insulation.

C. Execution

1. Protect flooring and equipment with drip cloths.
2. Paint and materials stored in location where directed.
3. Oily rags and waste removed from building every night.
4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint if applied.
5. Workmanship.
   a. No painting or finishing shall be done with:
      1) Dust laden air.
      2) Unsuitable weather conditions.
      3) Space temperature below 60 degrees Fahrenheit.
   b. Pipes painted containing no heat and remain cold until paint is dried.
   c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls, or other defects.
   d. Finished surfaces shall be uniform in sheen, color and texture.
   e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats.
   f. Priming undercoat of slightly different color for inspection purposes.
6. Piping continuously painted in all exposed areas.

D. Paint

1. High gloss medium or long alkyd paint.
2. Best grade for its purpose.
3. Deliver in original sealed containers.
4. Apply in accordance with manufacturer’s instructions.

E. Colors

1. Colors as directed by Owner’s Representative unless specified herein.
2. Condenser water piping: pale green.
3. Interior of ductwork as far back as visible from outside: flat black.

4. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer.

F. Factory finish

1. Ceiling and wall mounted air outlets in acoustical tile ceilings: Baked white enamel.
2. Aluminum air outlets that are not to be painted: anodized.

G. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat.

H. Properly prepare Work under this Division to be finish painted under Division 9 Painting.

I. Provide moisture resistant paint for exterior painting and heat resisting paint for hot piping, equipment, and materials.

J. Factory Finishes

1. Exposed fan coil units: baked enamel.
2. Unit ventilators and unit heaters: baked enamel.
3. Fans, pumps, compressors, tanks and like items.
4. Air handlers, pumps, water heaters and like items where exposed.

K. For the following, provide factory prime coat. Also, provide factory finish painting on each if not specified in Painting Division.

1. Other air outlets

L. Paint all equipment out-of-doors and equipment supports with two coats of weather resistant enamel.

M. Protect all finished surfaces of fixtures with heavy paper pasted thereon, or by other means, throughout the period of construction.

N. Refinish Work supplied with final finish under this Division if damaged under this Division to satisfaction of Owner's Representative.

3.8 FIELD QUALITY CONTROL

A. See Division 1 – Quality Control

B. Tests

1. Perform as specified in individual sections and as required by authorities having jurisdiction.
2. Perform commissioning work.
   a. Perform pre-function tests as specified in Division 23 – Mechanical.
   b. Perform functional and post-occupancy tests.
3. Duration as noted.

C. Provide required labor, material, equipment, and connections.

D. Furnish written report and certification that tests have been satisfactorily completed.

E. Repair or replace defective work, as directed by Owner's Representative in writing, at no additional cost to the Owner.

F. Restore or replace damaged work due to tests as directed by Owner's Representative in writing, at no additional cost to the Owner.

G. Restore or replace damaged work of others, due to tests, as directed by Owner's Representative in writing, at no additional cost to the Owner.

H. Remedial work shall be performed to the satisfaction of the Owner's Representative, at no additional cost to the Owner, including:

1. Work related to all Division 23 – Mechanical pre-functional tests.
2. Division 23 – Mechanical work related to Section 23 05 93 – Testing, Adjusting and Balancing.
3. Division 23 – Mechanical work related to Section 23 08 00 – Commissioning of HVAC.

I. Remedial work shall include performing any commissioning or other tests related to remedial work for an additional time at no additional cost to the Owner.

END OF SECTION

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Motors
2. Variable speed drives
3. Motor controllers where provided as part of mechanical equipment

B. Related Sections

1. Section 23 00 50 – Basic Mechanical Materials and Methods
2. Section 23 08 00 – Commissioning of HVAC

1.2 REFERENCE STANDARDS

A. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings

B. ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings

C. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators

D. ANSI/NEMA MG 1 – Motors and Generators

E. ANSI/NFPA 70 – National Electrical Code, as amended by California Electrical Code

F. IEEE – Standard 519-1992, IEEE Guide for Harmonic Content and Control

G. NEMA – ICS 7.0, AC Adjustable Speed Drives

H. Underwriters laboratories – UL508C

1.3 SUBMITTALS

A. Submittals shall include certification from the motor manufacturer certifying compliance with NEMA MG-1, part 31 for motors that are driven by variable speed drives.

B. Submit a site-specific harmonic analysis showing total voltage harmonic distortion and total current harmonic distortion is in compliance with IEEE 519. If the analysis indicates that additional external devices or filters are required to meet the power quality requirements of the VSD, provide the devices or filters at no additional cost to the University. See Paragraph 2.3B.2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Motors

1. MagnaTek
2. Century Electric Co.
3. General Electric
4. Lincoln Electric Co.
5. Gould Inc.
6. Baldor
7. Or equal

2.2 MOTORS

A. General

1. In accordance with NEMA, IEEE, and ANSI C50 standards
2. Capacity:
   a. Minimum horsepower indicated.
   b. To operate driven devices under all conditions without overload.
3. Squirrel-cage induction type, NEMA Type "B: insulation class, continuous duty.
4. Speed:
   a. 1750 RPM, unless otherwise indicated.
   b. See schedules on drawings for other speeds.
5. NEMA KVA locked rotor CODE LETTER: "G" or better.
6. Service factor.
   a. Drip-proof enclosure (ODP): minimum service factor 1.15.
   b. Totally enclosed fan cooled (TEFC): minimum service factor 1.15.
7. Type:
   a. 1/3 horsepower and smaller: AC motor single-phase, 60 hertz, NEMA rated for 110 volt: With built-in overload protection.
   b. 1/2 horsepower and larger: AC motor 3 phase, 60 hertz, AC motor, NEMA rated for 460 volt or as scheduled on Drawings.
   c. Motors 50 horsepower and over: Reduced voltage start, suitable for star-delta starting.
8. Bearings, except as noted:
   a. Provide motors with double shielded, grease lubricated, ball bearings, with grease pockets on each side for re-greasing in service. Provide inlet and outlet grease connections in motor housings for each bearing. Provide factory sealed permanently lubricated ball bearings on roof mounted equipment. Similar bearing may be provided on fractional horsepower motors. Provide sleeve bearings where so specified.
   b. Ball type, unless otherwise noted.
   c. Sealed, permanently lubricated, unless otherwise noted or not available in motor size.

B. Enclosure:

1. Open drip-proof (ODP)

a. Provide ODP motors unless otherwise indicated
2. Totally enclosed (TEFC)
   a. Motors outside the building or otherwise exposed to the weather
   b. Non-ventilated: under 1/2 horsepower
   c. Fan-cooled: 1/2 horsepower and larger
3. See schedules on drawings for other enclosures

C. Belt-connected motors

1. Foundation slide base
2. Shaft as required for aligning pulleys

D. Efficiency

1. Except where otherwise noted in schedules, motor efficiency for motors shall be Standard efficiency.

2. Where Premium Efficiency motors are called for, motors shall have guaranteed minimum efficiencies equivalent to or exceeding NEMA Table 12-6D levels and NEMA Premium labeled:

NEMA MG-1, Table 12-6D Nominal Efficiency for ODP and TEFC Motors									
HP	eff	HP	eff	HP	Eff	HP	eff	HP	Eff
1	85.5	5	89.5	20	92.4	50	94.1	125	95.4
1.5	86.5	7.5	91.0	25	93.6	60	94.5	150	95.8
2	86.5	10	91.0	30	93.6	75	95.0	200	95.8
3	89.5	15	92.4	40	94.1	100	95.4		

3. Fractional horsepower motors 1/20 HP and larger shall not be shaded pole motors

E. Multi-speed motors

1. Two speed motors shall be single winding 1800/900 rpm unless otherwise specified or indicated
2. Provide 1800/1200 rpm multi-speed motors of separate winding, variable torque type, unless otherwise specified or indicated.

F. See DIVISION 26: ELECTRICAL

G. Refer to individual equipment sections for factory-provided controllers

1. Installed on equipment by manufacturer
2. Supplied with equipment by manufacturer for field installation

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 23 0548 – Mechanical Sound, Vibration, and Seismic Control

B. Coordinate with work of other trades

C. Install in accordance with manufacturer's written installation instructions

D. Drives for packaged equipment shall be mounted and wired by equipment manufacturer

E. Mounting and power wiring of field mounted variable speed drives and other motor controllers are specified under Division 26 Electrical:

1. Where wall space is not available for mounting VSDs or other motor controllers, provide mounting struts securely mounted to the floor, roof, or adjacent structure
2. Where VSD has disconnect switch, locate VSD within sight of equipment served so that switch complies with NEC requirements

F. Set overload devices to suit motors provided in accordance with NEC

3.2 INSPECTION

A. Verify that adequate clearance between motor, controllers and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that motor and controller are properly supported and allows for proper alignment and tension adjustments as necessary for application.

3.3 PRE-OPERATING CHECKS

A. Before operating motors and controllers

1. Check for proper and sufficient lubrication
2. Check for correct rotation
3. Confirm alignment and re-align if required
4. Check for proper adjustment of vibration isolation.

3.4 STARTUP, TESTING, AND ADJUSTING

A. Start and test motors and controllers in accordance with manufacturers written installation instructions.

B. After starting motors:

1. Check for high bearing temperatures.
2. Check for motor overload by taking ampere reading at maximum operating conditions, with all valves open and individual motor running.
3. Check for objectionable noise or vibration; correct as needed at no additional cost to the Owner.

C. See Section 230593 – Testing, Adjusting, and Balancing

D. See Section 230800 – Commissioning of HVAC

3.5 TRAINING

A. See Section 230800 – Commissioning of HVAC

END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Equipment supports.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Division 23 Section(s) Ducts for duct hangers and supports

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

D. Welding certificates.

1.6 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. Flex-Strut Inc.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut Corporation; Tyco International, Ltd.
   g. Wesanco, Inc.
   h. ERICO International Corporation.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Epoxy.
9. Plastic Coating: Epoxy.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International; a subsidiary of Mueller Water Products Inc.
   b. Empire Industries, Inc.
   c. ERICO International Corporation.
   d. Haydon Corporation; H-Strut Division.

e. NIBCO INC.
f. PHD Manufacturing, Inc.
g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

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

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, non-corrosive, and non-gaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads and at changes in direction of piping.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Insulated Piping:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS ½ inch to NPS 3-1/2 inch:12 inches (305 mm) long and 0.048 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

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

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

F. Use thermal-hanger shield inserts for insulated piping and tubing.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS ½ inch to NPS 3 inch.
2. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS ½ inch to NPS 3 inch.
3. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS ½ inch to NPS 3 inch.
4. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary NPS ½ inch to NPS 3 inch.
5. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS ½ inch to NPS 3 inch.
6. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS ½ inch to NPS 3 inch.
7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS ¾ inch to NPS 3 inch.

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13):
2. Steel Clevises (MSS Type 14):
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17).

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40).
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
4. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
5. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Vibration isolators for equipment
2. Vibration isolators for piping systems
3. Equipment bases
4. Inertia bases
5. Seismic control for equipment on isolators
6. Seismic bracing and restraints for piping and ductwork
7. Seismic bracing and restraints for rigidly mounted equipment
8. Seismic bracing and restraints for flues

B. Related Sections

1. Section 23 0050 – Basic Mechanical Materials and Methods
2. Duct sound attenuators, see Section 23 33 00 – Duct Accessories

1.2 REFERENCE STANDARDS

A. AFBMA – Anti-Friction Bearing Manufacturer's Association

B. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers

C. NEMA – National Electrical Manufacturer's Association

D. Underwriters' Laboratories, Inc.: UL 778 – Motor Operated Water Pumps

E. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

F. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below:

1. Mason Industries “Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”
2. SMACNA and PPIC “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems”.
   a. Publication references below are basic industry standards; however, regulatory requirements may reference, modify, or supersede:
3. American Institute of Steel Construction (AISC) publications
   a. Specification for the Design, Fabrication and Erection of Structural Steel Buildings (Eighth Edition)
4. American National Standards Institute (ANSI) Standard

a. B027.2-965 – Plain Washers
5. American Society for Testing and Materials (ASTM) Specifications

1.3 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers:
   a. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture for not less than five years

B. Manufacturer or manufacturer's representative of vibration isolation equipment shall have the following responsibilities

1. Determine vibration isolator sizes and locations
2. Provide piping and equipment isolation systems as scheduled or specified
3. Guarantee specified isolation system static deflection under installed actual load.
4. Provide installation instructions, drawings, and field supervision to assure proper installation, adjustment, and performance.

C. The installation of all vibration isolation units and associated hangers and bases shall be as directed by the vibration isolation manufacturer's representative.

D. It is the objective of this Specification to provide the necessary design for the control of excessive noise and vibration in the building due to the operation of machinery or equipment, and due to interconnected piping, ductwork, or conduit

1. All vibration isolators shall have either known un-deflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50 percent greater than the design deflection.
3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10 percent.
4. All neoprene mountings shall have a Shore hardness of 30 to 60 ±5, after minimum aging of 20 days or corresponding oven-aging.

E. Acoustical Testing

1. The contractor shall cooperate with regard to sound tests (ARI 575, ANSI S1.13) which may be conducted by the Owner’s Representative to verify that noise criteria are met.
2. The contractor shall notify the Owner’s Representative of any changes which will affect the acoustical performance.

F. Seismic load calculations for piping, ductwork, and equipment

1. Fp, the total design lateral seismic force, shall be calculated by a licensed structural engineer, unless it is explicitly stated in the plans or specifications. This engineer shall be hired by the contractor responsible for this Section of work.
2. Shall meet California Building Code requirements
3. Calculations required for supports and bracing for situations not covered by referenced Guidelines, see Paragraph 1.1B
    a. Hired by contractor under this Section or work
    b. Cost of calculations borne by contractor under this Section
4. Calculations made and signed by registered civil or structural engineer knowledgeable in seismic design
5. Include horizontal and vertical reaction loads at connections to building structures for all seismic restraints, including those covered by referenced Standards
    a. Coordinate reaction loads and attachment details with structural engineer for building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Vibration Isolation

1. Mason Industries, Inc.
2. Kinetics Noise Control, Inc.
3. M.L. Saussé & Co. (Vibrex)
4. Amber-Booth
5. Or equal.

C. Seismic Restraints

1. Hangers and snubbers: Any manufacturer who can verify compliance with SMACNA standards and the California Building Code
2. Strut - Channel Framing: Any manufacturer who can verify compliance with the ICBO standards
3. Anchors - Drill in, wedge type: Any manufacturer within the ICBO standards approved for seismic
4. Snubbers: Any manufacturer within the ICBO standards

2.2 VIBRATION ISOLATOR TYPES

A. Spring type

1. Spring isolators shall incorporate following
    a. All springs to be single coil steel with minimum spring coil outer diameter 0.8 of loaded operating height
    b. Horizontal spring stiffness within 0.8 to 1.25 times rated vertical spring stiffness
    c. Corrosion resistance
        1) Where exposed to corrosive environment including but not limited to:

a) Outdoors
b) Exposed to outdoor air within 5 feet of outdoor air intake

2) Corrosion protection: painted with outdoor paint
3) Springs neoprene coated
4) Hardware cadmium plated
5) All other metal parts hot dip galvanized

d. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection
e. Designed and installed so that ends of springs remain parallel; neoprene cups not acceptable
f. Noise pads of ½ inch or 1 inch thickness below the spring base to reduce the chance that the springs shall be resonant with equipment forcing frequencies or support structure natural frequencies. See Table in Paragraph 3.4B.
g. Leveling device
h. Where operating weight differs from installed weight provide built-in adjustable limit stops to prevent equipment rising when weight is removed. Stops shall not be in contact during normal operation.

2. Type "A": Similar to Mason Type SLF
3. Type "B": same as Type "A" except
   a. Provide built-in resilient vertical limit stops
   b. Tapped holes in top plate for bolting to equipment
   c. Capable of supporting equipment at fixed elevation during equipment erection
   d. Mason Type SLRS or equal for 1 inch and 2 inch deflection, Type SLR Series 100 for 3 inch to 5 inch deflection
4. Type "C": spring hanger rod isolators shall incorporate the following
   a. Spring element seated on steel washer within neoprene cup
   b. Steel retainer box encasing spring and neoprene cup
   c. Minimum 1/2 inch clearance between retainer box and spring hanger rod
   d. Minimum 15 degrees angular clearance between rod and retainer box
   e. Double deflection neoprene element at top of hanger box
   f. Mason 30N or equal

B. Elastomer mounting types

1. Type "D": Double deflecting type incorporating following
   a. Bolt holes for bolting to equipment base
   b. Bottom steel plates for bolting to sub-base as required
   c. Unit type design molded in black oil-resistant neoprene
   d. Neoprene compounded to meet following:
      1) Not greater than 50 durometer
      2) Minimum tensile strength 2000 pounds per square inch
      3) Minimum elongation 300 percent
      4) Maximum compression set of 25 percent of the original deflection
   e. Mason Type ND or equal (where seismic restraint not required by CBC)
   f. Mason Type BR or equal (where seismic restraint required by CBC)
2. Type "E": Elastomer hanger rod isolators shall incorporate following
   a. Molded unit type neoprene element
   b. Compounding described in Type "D" above
   c. Steel retainer box encasing neoprene mounting.
   d. Minimum 1/2 inch box

e. Mason Type HD or equal

3. Type "F": pad type elastomer mountings to incorporate following
   a. 5/16 to 3/8 inch minimum thickness per layer
   b. 50 psi maximum loading
   c. Ribbed or waffled design
   d. 1/16 inch galvanized steel plate between multiple layers of pad thickness
   e. 1/16 inch deflection per pad thickness
   f. Suitable bearing plate to distribute load
   g. Bolts through equipment and pad shall be oversized and provided with resilient washers, bushings and lock nuts
   h. Mason Type W Series or equal
4. Type "G": Pad type elastomer mountings to incorporate following
   a. High quality bridge bearing neoprene
   b. Maximum loading 800 psi
   c. Suitable bearing plate to distribute load
   d. Minimum thickness 2 inch
   e. Mason Type BBP or equal
5. Type "H": Combination spring/elastomer hanger rod isolators to incorporate following:
   a. Spring and neoprene isolator elements in steel box retainer
   b. Characteristics of spring and neoprene as described in Type "C" and Type "E" hanger isolators
   c. Factory preloading to 75 percent of rated load
   d. Mason PC30N or equal

C. Seismic Snubbers

1. Type SS: All-directional seismic snubber
2. Neoprene bushing to be bridge bearing quality
3. Male portion to be smooth round bar; threaded bolts not acceptable
4. Mason Z-1225 or equal

2.3 EQUIPMENT BASES

A. Integral structural steel bases, Type "B-1"

1. Reinforced as required to prevent base flexure at start-up and misalignment of drive and driven units
2. Fan bases complete with motor slide rails
3. Drilled for drive and driven unit mounting template
4. Mason Type WFSL or equal

B. Concrete inertia base, Type "B-2"

1. Formed in structural steel frame
2. Structural base reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transferal into equipment
3. Minimum thickness of the inertia base shall be 6 inches or greater if required to meet weight ratio specified below
4. Fan bases complete with motor slide rails

5. Pump bases shall be large enough to support suction and discharge elbows and suction diffusers
6. Bases complete with
    a. Height saving brackets
    b. Reinforcing
    c. Equipment bolting provisions
    d. Isolators provided by vibration control supplier, type as scheduled
7. Base ready for concrete pour
8. Inertia Base Weights
    a. Centrifugal Fans, except as noted: Minimum 1.0 times weight of fan, motor and drive
    b. Air handling Units, except as noted: Minimum 1.0 times weight of fan and coil cabinet, coils, fan, motor and drive
    c. Pumps: Minimum 1.5 times weight of pump, motor and base
        1) Base to be sized to support suction diffuser when used
    d. Air compressors
        1) Minimum 2 times weight of compressor, motor and base
        2) Weight can be reduced by weight of tank when tank mounted unit is provided.
9. Mason Type KSL/BMK or equal

C. Seismic restraint, Type I

1. All directional type
2. Steel and elastomeric
3. Mason Type Z-1225 or equal

D. Seismic restraint, Type II

1. Criteria
    a. Designed for seismic force criteria specified in Part 3
    b. Submit application details for approval

2.4 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the ICBO standards

B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following

1. ICBO evaluation report
2. Lab test report verifying compliance

C. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips

D. All over-head concrete anchors or inserts shall be selected to comply with the ICBO report or CBC table for the anchor or insert

E. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall

be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

F. Bolts and nuts

1. Bolts and heavy hexagon nuts: ANSI B18.2.1 and ASTM A307 or A576
2. Bolts, underground: ASTM A325
3. Expansion anchors: Federal Specification A-A-1922

2.5 SEISMIC RESTRAINTS

A. General

1. Capable of safely accepting indicated external forces without failure
2. Maintain equipment, piping, and ducts in a captive position

B. Criteria: Design for seismic forces specified herein

C. Bracing system: Provide one of the following methods as most applicable for each brace

1. Material used, except for pipes, shall be structural steel with ASTM A36. Steel pipes shall conform to ASTM A501
2. Complete system of factory fabricated components
3. Complete system of job fabricated components
4. Miscellaneous metal structural shapes

2.6 FLEXIBLE PIPE CONNECTORS

A. Piping Connections for Vibration Isolation

1. Molded twin-sphere type connectors made of peroxide cured EPDM and Kevlar tire cord reinforcement
2. Connectors up to 2 inch diameter may have threaded ends
3. Connectors 2-1/2 inch diameter and larger to have floating steel flanges recessed to lock the connector's neoprene flanges
4. Connectors rated a minimum of 150 pounds per square inch at 220 degrees Fahrenheit without control rods or cables
5. Mason SAFEFLEX Type SFDEJ or equal

B. Piping Connections at Seismic Joints

1. Flexible hose configuration capable of the following seismic motion in all planes:
   a. At seismic joints: 4 inches
   b. At base isolation interconnections: 30 inches
2. 304 stainless steel hose and braid
3. 125 250 psi rated
4. Connectors up to 2 inch diameter may have threaded ends
5. Connectors 2 inch and larger shall have free floating flange or grooved connection
6. Mason SS 60º Vee

2.7 FLEXIBLE DUCT CONNECTORS

A. See Section 23 31 13 – Ducts

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install isolators and seismic restraints in accordance with manufacturer's written instructions.

B. Vibration isolators must not cause any change of position of equipment or piping resulting in piping stresses or misalignment.

C. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified

1. Electrical conduit connections to isolated equipment shall be flexible liquid tight conduit of sufficient length to incorporate a right angle bend, an offset of not less than 8 inches or a loop to allow free motion of isolated equipment.
2. The HVAC Sub-contractor shall not install any equipment, piping or conduit which makes rigid contact with the building unless permitted in this Specification; building includes, but is not limited to, slabs, beams, columns, studs and walls.
3. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.

D. Do not use isolator leveling bolts as jacking screws

E. Verify that all installed isolators and mounting systems permit equipment motion in all directions.

3.2 SEISMIC CONTROL

A. General

1. Install seismic restraints for pipes, ducts, and equipment per applicable code.
2. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning or uplift.
   a. Prepare designs and include on shop drawings, including arrangements, sizes and model numbers indicated or referenced in applicable standards. Each shop drawing shall bear a Structural or Civil Engineer’s stamp and signature registered in the State of California.
   b. Where designs, etc., are neither indicated nor referenced, contractor shall submit such designs, together with supporting calculations prepared by Structural or Civil Engineer registered in State of California. Calculations shall substantiate seismic restraint capability to safely accept external forces without failure and maintain equipment in position.
   c. Capable of safely accepting external forces per CBC without failure.
3. Provide resilient restraining devices as required to prevent equipment motion in excess of 1/4 inch.
4. Coordinate seismic bracing requirements with other sections to result in

a. Vertical pipe and duct restraints to coincide with and take place of required hangers.
b. Longitudinal pipe bracing to coincide with required pipe anchors.

5. Shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.

B. Attachments to Structure: See Section 23 05 29 – Hangers and Supports

3.3 FLOOR MOUNTED EQUIPMENT

A. Concrete housekeeping pads:

1. Isolation and seismic restraint supplier to determine dimensions and thickness required.
   a. Minimum thickness: 5.5 inches
2. Support all vibration isolation devices and bases.
3. Key with stirrups as required, integral with structural slab.
4. Incorporate seismic restraint anchor plates flush with top of housekeeping pad.

3.4 EQUIPMENT ISOLATION

A. General

1. Provide 1-inch operating clearance between equipment or structural bases and housekeeping pad.
   a. 1-inch minimum clearance for inertia bases over 96 inches in any dimension.
2. Position equipment, structural base and concrete bases on blocks or wedges at proper operating height.
3. Provide operating load conditions prior to transferring base isolator loads to springs and removing wedges.
4. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4 inch.
5. Prior to start-up, clean out all foreign matter between bases and equipment.
6. Verify that there are no isolation short circuits in the base, isolators or seismic restraints or conduit, pipe, and duct connections.
7. Position all corner or side seismic restraints with equipment in operation for proper operating clearance. Weld or bolt seismic restraints to seismic anchor plates in housekeeping pad.

B. Vibration Isolator Schedule:

Equipment	Base Type	Isolator Type	Isolator Static Deflection	Acoustical Base Pad Thickness
Suspended fan-coils, AC, HP	None	C	1 inch	–
Roof/Floor-mounted fans <10 HP	B-1	A	1 inch	1/2 inch
Roof/Floor-mounted fans > 10 HP				

Equipment	Base Type	Isolator Type	Isolator Static Deflection	Acoustical Base Pad Thickness
<300 RPM	B-1 (B-2 if 50 HP or larger)	A	3.5 inch	1/2 inch
300-450 RPM	Ditto	A	3 inch	1/2 inch
451-600 RPM	Ditto	A	2.5 inch	1/2 inch
601-750 RPM	Ditto	A	2 inch	1/2 inch
751-850 RPM	Ditto	A	1.5 inch	1/2 inch
>850 RPM	Ditto	A	1 inch	1/2 inch
Suspended fans direct drive	None	E	0.2 inch	–
Suspended fans belt drive	None	C	As for floor mounted fans plus 1/4 inch	As for floor mounted fans
Piping				
Roof/Floor supported	None	B	1 inch	-
Suspended <2 inch	None	H	1 inch	-
Suspended 2 inch & less	None	E	1/4 inch	-

3.5 PIPING AND DUCTWORK ISOLATION

A. Refrigerant Piping

1. Hang pipe with spring type vibration isolator.

B. Pipe Risers

1. For pipe risers less than 75 feet, vertical risers shall be laterally supported with a riser clamp at each floor set on a Type F isolation pad, ¼" deflection.
2. For pipe risers greater than 75 feet, riser supports shall be engineered by the vibration isolation vendor as follows:
   a. All vertical risers shall be supported by spring isolators designed to support the riser filled with water. Assigned loads must be within the building design limits at the support points.
   b. Neutral central resilient anchors close to the center of the run shall direct movement up and down. The anchors shall be capable of holding an upward force equal to the water weight when the system is drained. If one level cannot

accommodate this force, anchors can be located on 2 or 3 adjacent floors. Anchors shall be Mason ADA or equal.

c. Resilient guides shall be spaced and sized properly depending on the pipe diameter. Guides shall be Mason VSG Vertical Sliding Guides or equal.
d. Support spring mountings shall be Type A. The initial spring deflection shall be a minimum of 0.75 inches or four times the thermal movement at the isolator location, whichever is greater.
e. Submittals must include the initial load, initial deflection, change in deflection, final load and change in load at all spring and anchor support locations, as well as guide spacing. Calculations shall include pipe stress at end conditions and branch off locations and the manufacturer must include installation instructions. Submittal must be stamped and signed by a licensed professional engineer in the employ of the vibration isolator vendor.

C. Wall and Floor Penetrations

1. All piping and ductwork to be vibration isolated, and all piping and ductwork passing through acoustically rated partitions, shall freely pass through walls and floors without rigid contacts or connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain 0.75 inches to 1.25 inches clearance around the pipe or duct outside surfaces.
   a. For installations through air plenum partitions and through acoustically rated partitions, clearance space shall be tightly packed with fiberglass, and caulked airtight after installation of piping or ductwork
   b. For installation in rated walls, see Section 23 2113 – Hydronic Piping and Section 23 3113 – Ducts
2. Provide sleeves and escutcheons as specified in Section 23 2113 – Hydronic Piping and Section 23 3113 – Ducts.

3.6 SEISMIC BRACING INSTALLATION

A. Piping and Ductwork

1. Bracing system shall meet the seismic load requirements (See Section 1.3F).
2. Install all bracing and restraints per referenced Guidelines, see Paragraph 1.1B, where applicable.
3. Where the referenced Guidelines, see Paragraph 1.1B, are not applicable then submit details of a proposed bracing system. The proposed system shall be stamped by a licensed civil or structural engineer and shall be submitted for approval prior to construction.
4. Coordinate seismic bracing and restraints so that required expansion provisions will not be restricted.
5. Provide floor support and bracing of pipe connection risers to equipment.
6. Where seismic bracing and restraints are not required refer to Section 15060 – Hangers and Supports.

B. Flexibly Supported Piping and Ducts

1. Provide and locate restraints to allow normal operation of systems without transmitting vibrations to building structure.

2. Location of Restraints: Per referenced Guidelines, see Paragraph 1.1B, as specified herein before.
3. Construction of Restraints: Steel cables, installed slack.

C. Rigidly Mounted Equipment

1. Secure to floor as required to prevent horizontal motion and overturning.
2. Secure to walls or other equipment to prevent overturning.
   a. Attach to elements capable of taking calculated loads.
   b. Provide steel backing in walls as required to brace equipment and piping from wall.

3.7 FIELD QUALITY CONTROL

A. Inspection by manufacturer's representative of all vibration isolating devices.

1. After installation of all devices.
2. Provide written report by manufacturer regarding.
   a. Installation errors.
   b. Improper selection of devices.
   c. Other fault that could affect performance of system.

B. Submit written report to Owner’s Representative.

1. Include manufacturer's report indicating required corrections.
2. Include report on steps to properly complete isolation work.

C. See Section 230800 – Commissioning of HVAC

END OF SECTION

SECTION 230593
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Operational testing and adjusting of air handling equipment.
2. Balancing of air distribution systems
3. Adjustment of air terminal devices
4. Flow testing, adjusting, and balancing of hydronic systems.

B. Related Sections

1. Section 23 00 50 – Basic Mechanical Materials and Methods
2. Section 23 31 12 – Ducts
3. Section 23 08 00 – Commissioning of HVAC

1.2 REFERENCE STANDARDS

A. National Environmental Balancing Bureau Procedural Standards.

B. Associated Air Balance Council National Standards.

C. ASHRAE Standard 111 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilating, and Air-Conditioning Systems.

1.3 QUALITY ASSURANCE

A. Contractor shall be member of Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).

B. Contractor shall have satisfactorily balanced at least three systems of comparable type and size.

C. Prior to start of testing, adjusting, and balancing, verify that required Project conditions are met.

1. Systems installation is complete and in full operation.
2. All pre-functional tests have been performed.
3. Equipment has been started and tested in accordance with manufacturers' written installation instructions.
4. Doors and windows are in place or under normal traffic conditions.

1.4 SUBMITTALS

A. See Section 23 00 50 – Basic Mechanical Materials and Methods.

B. Submit to Owner's Representative documentation that:

1. Contractor is a member of Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).
2. Contractor has satisfactorily balanced at least three systems of comparable type and size.
    a. Include list of such projects.
    b. Include sample forms for use in compiling and recording test and balance data.

C. Pre-Test Submittal

1. At least 15 days prior to starting field work, submit paper copies of the following:
    a. Set of final report forms.
        1) Complete with design conditions of all equipment and design flow rates for all equipment and devices to be balanced.
        2) Forms shall include blank entry space for all data requested in this Section. Carefully review requested data; standard balancing forms may not be acceptable.
        3) Verify that forms are in acceptable word-searchable electronic format per Section 23 0050 – Basic Mechanical Materials and Methods.
    b. Complete list of instruments proposed to be used:
        1) Organize in appropriate categories.
        2) Include data sheets for each.
        3) Show
            a) Manufacturer and model number.
            b) Description and use when needed to further identify instrument.
            c) Size or capacity range.
            d) Latest calibration date.
    c. Provide certification that:
        1) All instruments have been calibrated prior to tests.
        2) Instruments comply with requirements of AABC or NEBB for tests required.
        3) Contractor is currently certified by AABC or NEBB.

2. Do not proceed with field work until the above submittal has been approved by Owner's Representative.

D. Final Test & Balance Report

1. At least 15 days prior to Contractor's request for final inspection, submit three paper copies of final reports on approved reporting forms for review and approval by Owner's Representative. Once approved, provide required quantity of paper and electronic copies per 23 0050 – Basic Mechanical Materials and Methods.
2. Form of Final Reports
    a. Fully completed report forms for all systems specified to be tested and balanced including at a minimum all data specified herein to be recorded.
    b. Each individual final reporting form must bear.
        1) Signature of person who recorded data.
        2) Signature of air balance supervisor of reporting organization.

c. When more than one certified organization performs total air balance services, firm having managerial responsibility shall make submittals.
d. Identify instruments of all types that were used and last date of calibration of each.

1.5 PROJECT REVIEW

A. Pre-Construction Review
1. Review following documents
a. Contract documents
1) Drawings
2) Specifications
3) Addenda
4) Change orders
b. Design intent documents
c. Submittal data
d. Shop drawings
e. Temperature control drawings
f. Pre-functional test reports
2. Assure that design intent and all sequences of operation are clearly understood.
3. Identify potential problems from standpoint of total system balance.
4. Review of specifications for:
a. Scope of work
b. Special requirements
c. Items that will make balancing difficult or impossible
5. Review of Drawings for:
a. Potential problems for total system balance
1) Location of balancing devices
2) Lack of balancing devices
3) General System layout
4) Architectural features
5) Accessibility
b. Most effective system balance procedures
c. Scheduling and coordination requirements
6. Review of submittal data for:
a. Completeness of data
b. Conformity with contract documents
c. Special instructions for use of balancing devices
d. Factors for flow meters
e. Limitations affecting accuracy of measurements.
f. Balancing forms shall show design data and submittal data where different.
g. Equipment performance data and curves
7. Review of shop drawings for potential problems for total system balance, as specified above for review of the contract Drawings.
8. Review of temperature control drawings for:
a. Thorough understanding of system functions
b. Determining most effective total system balance procedure for minimum control manipulation
9. Submit report recommending addition and/or relocation of balancing devices, including, but not limited to
a. Volume dampers

b. Flow metering devices, for air
c. Pressure and temperature measuring points.

B. Construction Review

1. Make on-site visits during the progress of construction: Number of visits to be as required to perform the functions specified below.
2. Purpose of review
   a. Identify potential problem for performing total system balance.
   b. Identify modifications that will affect air total system balance.
   c. Schedule and coordinate total system balance with other work.
   d. Identify conditions that could create hazardous environment for building occupants.
3. Typical activities
   a. Check that necessary balancing and measuring hardware is:
      1) In place
      2) Located properly and accessibly
      3) Installed correctly
   b. Identify and evaluate variations from system design
   c. Record data from equipment nameplates
   d. Identify and report possible restrictions in systems; such as
      1) Closed fire dampers
      2) Long runs of flexible duct
      3) Poorly designed duct fittings
      4) Questionable piping connections
      5) Others as may arise or based on contractor’s experience
   e. Verify that construction progress will not delay total system balance
   f. Identify best location for duct Pitot tube traverses
   g. Identify scaffolding needs

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified herein. If not otherwise noted, the following minimum requirements apply.

1. Volt-meter: plus or minus 1 percent scale.
2. Ammeter: plus or minus 1 percent scale.
3. Ohmmeter: plus or minus 0.1 percent scale for calibrating plus or minus 0.4 degrees Fahrenheit resistance temperature sensors, plus or minus 0.25 percent scale for calibrating plus or minus 1 degrees Fahrenheit temperature sensors, plus or minus 1 percent scale for measuring motor current.
4. Ultrasonic time-of-travel strap-on flow sensor: plus or minus 5 percent of reading.
5. Other flow sensors: plus or minus 2 percent of reading.
6. Watt meter, plus or minus1/2 percent scale: 3 phase split core current transducers.
7. Temperature: plus or minus 0.4 degrees Fahrenheit.

B. All equipment shall be calibrated within 6 months of use, or according to the manufacturer's recommended interval, whichever is shorter, and when dropped or damaged. Calibration tags shall be affixed or certificates readily available and proof of calibration shall be included reports.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with work of other trades.

B. Coordinate all work with Commissioning Coordinator.

1. See Section 23 08 00 – Commissioning of HVAC

C. Report to Owner's Representative any discrepancies or items not installed in accordance with the Contract Drawings pertaining to proper balance and operation of air and water distribution systems.

D. Perform testing, adjusting, and balancing in accordance with AABC or NEBB standards.

E. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to Section 23 0700 – HVAC Insulation.

F. Mark equipment settings with paint or other suitable, permanent identification material, including damper control positions, valve indicators, and similar controls and devices, to show final settings.

G. Assist in Title 24 Acceptance Testing as specified in Section 23 08 00 – Commissioning of HVAC.

3.2 AIR SYSTEM BALANCING

A. General:

1. Do not operate fan systems for test or balance until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.
2. Check that filters are installed, free of bypass, and clean; type as specified herein
   a. Make allowance for air filter resistance at time of tests.
      1) Pressure drop across filter banks midway between drop for clean and dirty filters at design airflow.
   a. For systems with construction prefilters and high efficiency final filters.
      1) Perform all zone level balancing with only pre-filter installed, no final filter, and system operating on 100 percent outdoor air.
      2) Immediately prior to occupancy, or to 100 percent outdoor air purge if that procedure is to be implemented; see Section 15050 – Basic

Mechanical Materials and Methods, replace prefilters with new clean filters and install final filters. With final filters in place, perform tests of air handling unit per Paragraph 3.3C followed by 100 percent outdoor air purge if required by Section 15050 – Basic Mechanical Materials and Methods.

3. In cooperation with Control installer, set adjustments of automatically operated dampers and valves to operate as indicated.
4. Balance hydronic systems prior to air balance and have operational during air balance for air temperature measurements.

B. Air Outlets:

1. Adjust diffusers' throw pattern, grilles and registers to pattern indicated on the Drawings.
2. Test and adjust each diffuser, grille and register to within plus or minus 10 percent of design requirements.
   a. Start with all dampers wide open.
   b. Adjust dampers, starting with nearest to terminal unit or fan. Make adjustments using duct mounted volume dampers rather than dampers at diffuser face unless absolutely required.
   c. At least one damper shall remain wide open at end of balance.
3. Plenum return air grilles or slots in lights: No balance required.
4. Read and Report:
   a. Tag each grille, diffuser and register and mark tag on copy of floor plan.
   b. For each grille, diffuser and register, indicate tag, size, type, and effective area (where applicable).
   c. Required velocity/cubic feet per minute.
   d. Initially tested velocity/cubic feet per minute
   e. Finally tested cubic feet per minute after adjustments.

C. Fan-coil Airflow Rate Readings:

1. Total supply air quantities shall be determined at all of the following where applicable:
   a. Pitot traverse in the supply duct downstream, positive pressure side of the fan.
   b. Pitot traverse at coil or filter bank.
   c. Totaling the readings of individual air outlets.
   d. Totaling the readings of individual terminals.
   e. Supply fan airflow sensor reading.

2. Total return air quantities shall be determined at all of the following where applicable:
   a. Pitot traverse in the return air duct or damper entering air handler
   b. Totaling the readings of individual air outlets, if ducted return system.
   c. Totaling reading of each return air shaft inlet, if multi-story plenum return system.
   d. Return fan airflow sensor reading.

3. Outside air quantities shall be determined by all of the following where applicable:
   a. Subtracting pitot traverses of supply and return ducts.

b. Pitot traverse of outdoor air intake duct.
c. Outdoor airflow sensor reading as.
d. Note: Balance by measurement of return air, outside air, and mixed air temperatures shall not be used due to inherent inaccuracy.

4. For systems with airflow measuring stations, measure airflow and coordinate with Control installer to calibrate airflow stations at a minimum of three conditions:
   a. Design airflow
   b. 50 percent of design airflow
   c. Minimum airflow

D. Fan-Coils

1. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed
   a. Adjust sheaves on fans with adjustable sheaves.
   b. Change sheaves on fans with fixed sheaves; see Paragraph 3.3F.
2. Test and adjust minimum outside air flow:
   a. Supply air fan shall first be operating at design airflow.
   b. For systems with economizers.
      1) Open return air damper fully.
      2) Adjust the outdoor air damper signal until the minimum outdoor airflow rate is achieved.
      3) Convey this minimum signal to Control installer and note on air balance report.
   a. For systems without economizers:
      1) Adjust minimum outdoor air or return air damper balancing damper position or linkage to deliver design minimum outdoor airflow rate.
      2) Clearly mark minimum damper position on damper housing
3. Test with system operating at minimum outside air flow condition described above and record the following on a schematic of the system:
   a. Tag
   b. Manufacturer and model of fan and motor
   c. Sheave data at motor and fan; belt data
   d. Motor HP, rpm, volts, phase, FLA
   e. Fan airflow rate at all locations measured, as listed above
   f. Final measured amps
   g. Static pressures measured at:
      1) Return air plenum
      2) Mixed air plenum
      3) Downstream of filter
      4) Downstream of coil
      5) Discharge of fans
   h. Concurrent airflow rate readings from airflow sensors, where applicable.
   i. Minimum outdoor air control signal, where applicable.
   j. Coil Performance:
      1) Test with:
         a) Associated pumps running in automatic maintaining differential pressure setpoint determined above.
         b) Central plan cooling (heating) equipment operational.

c) Controls adjusted to provide coil design water temperature entering coil.
d) Fan is running at design airflow.
e) Fully open control valve, allow steady-state to be reached, and measure.

2) Measure and record on a schematic of the system.
a) Entering water temperature.
b) Leaving water temperature.
c) Coil differential pressure drop.
d) Coil flow rate, from calibrated balance valve or deduced from manufacturer's coil flow vs. pressure drop data, see submittals.
e) Coil entering drybulb and wetbulb to cooling coils, drybulb only for heating coils.
f) Leaving supply air drybulb and wetbulb from cooling coils, drybulb only for heating coils
g) Documentation of three-way valve bypass balance valve per Paragraph 3.2F.

E. Constant Volume Exhaust Fans

1. See Paragraph 3.3B for air outlet balancing.
2. Total air quantities for fan shall be determined by both:
   a. Pitot tube traverse of main ducts near the fan inlet, and
   b. Totaling the readings of individual air outlets
3. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed:
   a. Adjust sheaves on fans with adjustable sheaves.
   b. Change sheaves on fans with fixed sheaves. See Paragraph 3.3F.
4. Test and record:
   a. Tag.
   b. Manufacturer and model of fan and motor.
   c. Sheave data at motor and fan; belt data.
   d. Motor horsepower, rpm, volts, phase, full load amps.
   e. Fan airflow rate at all locations measured, as listed above.
   f. Final measured amps.
   g. Inlet and outlet static pressure.

3.2 ADDITIONAL COSTS

A. Fans: If drives are not capable of being adjusted to meet required performance, inform Owner's Representative, and indicate added price to supply and install required sheaves. Do not include sheave changes in initial bid.

B. Pumps: If impeller must be trimmed, see Paragraph 3.2G.2, inform Owner's Representative and indicate added price to trim impeller and replace. Do not include impeller changes in initial bid.

C. Do not proceed until work is approved by Owner's Representative.

3.3 SPOT CHECKING

A. Spot checks shall take place after test and balance work is complete and reports have been prepared and approved.

B. Spot checks shall be witnessed by an Owner's Representative. Schedule spot checks with Owner's Representative at least 1 week prior to proposed test date.

C. Owner's Representative shall select subsets of any tested and balanced air or hydronic system to be spot-checked on the day of tests without prior notice to the Contractor.

1. Spot-checking will not require more than one working day.
2. If additional spot checks are requested by the Owner's Representative causing the time limit above to be exceeded, inform Owner's Representative, and indicate added price to perform the additional tests. Do not include additional tests in initial bid.

D. Discrepancies

1. If any of the spot-check measurements differ more than 25 percent from those documented in test and balance reports, the Contractor shall completely rebalance the associated system. For balance discrepancies at or downstream of a VAV box, rebalance only is required at or downstream of that box.
2. If discrepancies as described above are found on more than 25 percent of the spot-checks for air systems, all air systems shall be rebalanced.
3. If discrepancies as described above are found on more than 25 percent of the spot-checks for hydronic systems, all hydronic systems shall be rebalanced.
4. Rebalance work shall be witnessed by an Owner's Representative at the option of the Owner's Representative.
5. All rebalance work shall be documented, and documentation shall be resubmitted as specified above.
6. All rebalance work shall be provided at no additional cost to the Owner.

3.4 TRAINING OWNER PERSONNEL

A. See Section 23 08 00 – Commissioning of HVAC

B. Go over the final Testing, Adjusting and Balancing Report, explaining the layout and the meanings of each data type.

C. Discuss any outstanding deficient items in control, ducting, piping, or design that may affect the delivery of air or water.

D. Identify and discuss any systems or system components that are not meeting their design capacities.

E. Discuss any temporary settings and steps to finalize them for any areas that are not finished or fully occupied.

F. Any other appropriate points that may be helpful for facilities operations, relative to testing, adjusting, and balancing or the mechanical systems.

END OF SECTION 23 05 93

SECTION 230700
HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Piping insulation
2. Pipe insulation jacket
3. Equipment insulation
4. Ducts and plenums, thermal insulation
5. Duct and plenums, acoustic insulation
6. Duct and plenums, fire rated insulation.

B. Related Sections

1. Section 23 00 50 – Basic Mechanical Materials and Methods
2. Section 23 08 00 – Commissioning of HVAC

1.2 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation

F. ASTM E84 – Surface Burning Characteristics of Building Materials

G. ASTM E96 – Water Vapor Transmission of Materials

H. NFPA 255 – Surface Burning Characteristics of Building Materials

I. SMACNA – HVAC Duct Construction Standards - Metal and Flexible

J. UL 723 – Surface Burning Characteristics of Building Materials

K. ASTM E 814 – Standard Test Method for Fire Tests of Through-Penetration Fire Stops

L. UL 1978 – Standard for Grease Ducts

1.3 DEFINITIONS

A. Duct Dimensions

1. Where acoustical liner is indicated on the Drawings the duct sizes indicated shall be clear inside dimensions unless duct size is specifically indicated as outside dimensions (OD)

1.4 QUALITY ASSURANCE

A. Source Quality Control

1. Service: Use insulation specifically manufactured for service specified
2. Labeling: Insulation labeled or stamped with brand name and number

B. Applicator: Company specializing in performing the work of this section with minimum three years' experience

C. Fire Wrap Certification

1. The proposed fire-wrapping and fire-stopping shall be acceptable to the local authority having jurisdiction.
2. Provide evidence of AHJ approval in submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: fiberglass

1. Owens-Corning Fiberglass Corporation
2. Manville
3. Certainteed Corporation
4. Knauf
5. Or equal

C. Insulation: Elastomeric Closed Cell

1. Armstrong World Industries, Inc.
2. Rubatex Corporation
3. Or equal

D. Weatherproof Aluminum Jacket

1. Childers Products Company
2. Insul-Coustic/Birma Corporation
3. Or equal

E. Pre-molded pipe fitting covers and Jacketing

1. Manville: Zeston
2. Childers Products Company
3. Proto Corporation
4. Insul-Coustic/Birma Corporation
5. Or equal

F. Fire-rated Duct Wrap

1. 3M Fire Protection Products, Inc
2. Or equal

G. Adhesives

1. Foster Div. Amchem Products Inc.
2. Childers Products Company
3. Epolux Mfg. Corporation
4. Insul-Coustic/Birma Corporation
5. Armstrong 520 Adhesive
6. Or equal

H. Mechanical Fasteners

1. AGM Industries, Inc.
2. Miracle Adhesives Corporation
3. Grip-Nail
4. Or equal

2.2 GENERAL

A. Energy Codes: The current versions of California Title 24 and California Building Code shall govern where requirements for thickness exceeds thickness specified

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963)

1. Flamespread: maximum 25
2. Fuel contributed and smoke developed: maximum 50
3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable

C. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation

2.3 MATERIALS

A. Refrigerant Pipe Insulation

1. Flexible, closed cell elastomeric thermal insulation
    a. Insulation ASTM C534
    b. Service rating of 220 degrees Fahrenheit
    c. Density 6.0 pounds per cubic foot
    d. Closed cell foam: Vapor permeability ASTM E96 0.2 perm
    e. Max moisture absorption: 1.0 percent by volume, 10 percent by weight
    f. Molded pipe insulation
        1) Maximum 0.27 K factor at 75 degrees Fahrenheit mean temperature
        2) Maximum water vapor transmission rating of 0.17 perm-inches
    g. Sheet insulation
        1) Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature
        2) Maximum water vapor transmission rating of 0.17 perm-inches
    h. Seal with Rubatex adhesive or equal: Armstrong Armaflex II or equal
2. Calcium Silicate
    a. Insulation ASTM C 533, Type I
    b. Sectional with 14 pounds per cubic foot nominal density
    c. 0.40 maximum K-factor at 300 degrees Fahrenheit mean temperature and 1200 degrees Fahrenheit maximum service rating
    d. Waterproofed
    e. Flexural Strength 100 pounds per square inch
    f. Schuller Thermo-12 Gold or equal

B. Jackets For Exterior Installation

1. Factory Applied Vapor Barrier All Service Jacket (ASJ)
    a. ASTM C921, White kraft paper bonded to aluminum foil and reinforced with glass fiber yarn
    b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches
    c. Secure with self sealing longitudinal laps and butt strips
    d. Secure vapor barrier mastic
    e. Tie Wire: See Paragraph E.1, with twisted ends on maximum 12 inch centers
    f. Vapor Barrier Lap Adhesive: Compatible with insulation
2. Aluminum Jacket: ASTM B209
    a. Use for weatherproof jacket
    b. Thickness: 0.016 inch sheet
    c. Finish: Embossed
    d. Joining: Longitudinal slip joints and 2 inch laps
    e. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner
    f. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel

C. Preformed Pipe Fitting Covers

1. Aluminum
    a. Factory fabricated formed covers
    b. General Aluminum Supply Corporation GASCO or equal

D. Adhesives and coatings

1. Foster product names and figure numbers or equal

a. Lagging adhesive: 30-36
b. Fiberglass: Zeston Z-Glu
c. Vapor barrier coating: Tite-fit 30-80, UP Label, comply with MIL-C-19565C, Type II; fire and water resistant
d. Vaporseal adhesive: 85-60
e. Cellular glass bedding and sealing compound adhesive: Foamseal 30-45
f. Outdoor mastic: 30-90
g. Asphalt mastic: C.I. Mastic 60-25
h. For elastomeric insulation: 520 contact adhesive

E. Wire, banding and fastening devices

1. Wire: minimum 16 gauge copper clad annealed steel wire
2. Bands: 3/4 inches nominal width with wing seals, of minimum thickness as follows:
   a. Aluminum: 0.020 inches
3. Staples: outward clinching type of corrosion resistant steel

F. Mechanical Fasteners

1. Mild steel, copper plated
2. AGM Industries Power Base insulation pins or equal
3. Insulation washers
   a. Galvanized steel
   b. 1- 1/2 inch diameter
   c. AGM Industries SLW-1 or equal

G. Provide a continuous vapor seal for all refrigerant piping. Pre-insulated pipe support and shields

1. Provide insulated pipe supports for all insulated pipe and tubing. Insulated pipe supports shall be Pipe Shields, Inc. or equal
2. All insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
3. All insulated pipe supports shall have Calcium Silicate insulation and galvanized steel jackets. Pipe supports for use on flat surfaces shall have integral load distribution plates coated with zinc primer minimum 3 mils thick.
4. See Section 230529 Hangers and Supports
5. Hangers and supports shall fit outside of all pipe insulation and insulation inserts. Provide pre-insulated pipe supports as specified and install per manufacturer's installation instructions. Shield lengths and gauges shall also be per manufacturer's recommendations.

H. Fire-stopping

1. At pipe penetrations through rated assemblies.
2. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose.
3. Insulation shall be continuous through penetration.

I. Accessories

1. Insulation Protection Saddles: 12-inch long, 16 gauge steel
2. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the fitting covers, elastomeric, aluminum facing, Kraft paper, tapes, and adhesives

J. Equipment Insulation

1. Glass fiber, semi-rigid
    a. Insulation: ASTM C612; rigid, noncombustible
        1) 'K' ('ksi') value: ASTM C335, 0.24 at 75 degrees Fahrenheit
        2) Maximum service temperature: 450 degrees Fahrenheit
        3) Maximum moisture absorption: 0.1 percent by volume
        4) Density: 3.0 pounds per cubic foot density
    b. Vapor Barrier Jacket
        1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
        2) Moisture vapor transmission: ASTM E96; 0.04 perm
        3) Secure with self sealing longitudinal laps and butt strips. Minimum lap 2 inches
        4) Secure with bands, adhesive or ties
    c. Facing: 1 inch galvanized or stainless steel hexagonal wire mesh stitched on one face of insulation
    d. Vapor Barrier Lap Adhesive: Compatible with insulation
    e. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool
2. Jackets
    a. Aluminum
    b. Use for weatherproof jacket
    c. Thickness: 0.016 inch sheet
    d. Finish: Embossed
    e. Joining: Longitudinal slip joints and 2 inch laps
    f. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner
    g. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel
3. Equipment insulation facings: Foil-scrim-kraft laminate of aluminum foil facing, glass scrim reinforcing, kraft paper backing
4. Wires, bands and fastening devices
    a. Wires: Minimum 16 gage galvanized steel wire
    b. Bands: 3/4 inch nominal width wing seals, of minimum thickness as follows
        1) Aluminum: 0.007 inches indoors. Where exposed to weather 0.020 inches
        2) Stainless Steel: 0.010 inches

K. Duct Insulation

1. Duct Wrap With Vapor Barrier; Type DW-V
    a. Insulation: ASTM C553 and C612; flexible, noncombustible blanket
        1) 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees Fahrenheit
        2) Maximum service temperature: 350 degrees Fahrenheit
        3) Maximum moisture absorption: 0.20 percent by volume

b. Vapor Barrier Jacket - factory installed. (FSK)
    1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
    2) Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm
    3) Secure with pressure sensitive tape
c. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive
    1) Flexible fiberglass wrap. 3/4 pounds per cubic foot
    2) Installed conductance: 0.30 BTU-inch/hr/square foot/degree Fahrenheit
    3) Factory applied jacket
        a) Foil-scrim-kraft laminate: Aluminum foil facing
        b) Glass scrim reinforcing
        c) Kraft paper backing
    4) Maximum vapor permeance: 0.02 perms
d. Owens-Corning All Service Faced Duct-Wrap or equal

2. Duct Board Without Vapor Barrier; Type DB
    a. Insulation: ASTM C612; rigid, noncombustible blanket
        1) K (Ksi) value: ASTM C518, 0.23 at 75 degrees Fahrenheit
        2) Maximum service temperature: 350 degrees Fahrenheit
        3) Maximum moisture absorption: 0.20 percent by volume
    b. Installed conductance: 0.23 BTU-inch/hr/square foot/degree Fahrenheit
    c. Thickness per Paragraph 1.13A Duct Insulation Type and Thickness Schedule
    d. Owens-Corning Type 703 or equal
3. Duct Board With Vapor Barrier; Type DB-V
    a. Insulation: ASTM C612; rigid, noncombustible blanket
        1) 'K' ('Ksi') value: ASTM C518, 0.23 at 75 degrees Fahrenheit
        2) Maximum service temperature: 350 degrees Fahrenheit
        3) Maximum moisture absorption: 0.20 percent by volume
    b. Vapor Barrier Jacket - factory installed (FSK)
        1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
        2) Moisture vapor transmission: ASTM E96; 0.02 perm
        3) Secure with pressure sensitive tape
    c. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive
    d. Installed conductance: 0.23 BTU-inch/hr/square foot/degree Fahrenheit
    e. Thickness per Paragraph 1.13A Duct Insulation Type and Thickness Schedule
    f. Factory applied jacket
        1) Foil-scrim-kraft laminate
        2) Aluminum foil facing
        3) Glass scrim reinforcing
4. Tie Wire: Annealed steel, 16 gage

L. Duct and Plenum Lining

1. Rectangular Duct Lining; Type AL
    a. Material
        1) Insulation: ASTM C423
        2) 'K": ASTM C518, 0.23 at 75 degrees Fahrenheit

3) Maximum service temperature: 350 degrees Fahrenheit
4) Maximum moisture absorption: 0.20 percent by volume
5) Thickness per Paragraph 1.13A Duct Insulation Type and Thickness Schedule
6) 1-1/2 pounds per cubic foot unless shown otherwise to be 3 pounds per cubic foot
7) Installed conductance: 0.25 BTU-inch/hr/square foot/degree Fahrenheit

b. Interior air-side surface
1) Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, ASTM C665, ASTM G21
2) Suitable for velocity up to 4000 feet per minute
3) Meet erosion test method described in UL publication No. 181
4) Durable and mechanically cleanable
5) EPA registered anti-microbial agent
6) Certainteed Toughgard Duct Liner or equal
7) Adhesives
a) Duct Insulation, Internal: Foster 85-60 or equal
b) Weld Pins: Duro-Dyne CP or equal

2.4 DUCT FIREPROOFING

A. Material applied directly to metal ducts and achieving 1- or 2-hour fire rated separation (as required by application) when tested in accordance with UL 1978 by independent testing agency

1. Surface Burning Characteristics: Flame spread index of 0 and smoke developed index of 0, when tested in accordance with ASTM E 84, both blanket and foil.
2. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
3. Flexibility: Capable of being formed around corners and shapes by hand.
4. Fiber Content: Demonstrated to be soluble in the lungs according to EU 67/548/EWG, Note Q for bio-persistence.
5. Surface: Foil or other damage resistant surface; fiber not exposed after installation.
6. Accommodation for Duct Access Doors and Panels: Capable of being installed to achieve fire rating without impeding access.
7. Acceptable Product: 3M Fire Barrier Duct Wrap; fire resistant inorganic blanket encapsulated with scrim-reinforced foil facing

B. Fasteners: Non-combustible; use one or both of the following to attach fireproofing to ducts.

1. Banding: Steel or stainless steel, 1/2 inch wide, minimum, and 0.015 inch thick, minimum; with steel banding clips.
2. Insulation Pins: Copper-coated steel impalement pins, minimum 12 gages, for welded attachment, with galvanized steel self-locking washers, 1-1/2 inch square or diameter; or equivalent sized cup-head pins.

C. Access Panel Hardware: Galvanized threaded rods, sleeves, washers, and wing nuts as specified in manufacturer's instructions.

D. Tape: Aluminum foil tape for sealing exposed fiber edges and repairing tears in facing.

E. Fire-stopping: Material tested in conjunction with wrap in accordance with ASTM E 814 to achieve fire rated penetration seal at penetrations through fire rated assemblies.

1. Fire Rating: Same or greater than rating of penetrated assembly.
2. Acceptable Products: 3M Fire Barrier 1000 N/S, 1003 S/L, and 2000+ Silicone Sealants, as required by tested assembly

PART 3 - EXECUTION

3.1 REFRIGERANT PIPE & EQUIPMENT INSULATION SCHEDULE

A. Insulation Application Types Items noted "NIC" (Not in Contract) will be furnished and installed by Owner or under separate contract.

1. Type P-1A Refrigerant Piping: Cover with foamed plastic of closed cell structure ¾ inch thick. Armstrong Armaflex or Imcolock.
2. Type P-2
   a. Molded fiberglass
   b. All-service jacket
3. Type P-2A
   a. Molded fiberglass
   b. Aluminum preformed jacket or PVC jacket
4. Type P-3: Flexible elastomeric insulation
5. Type P-4
   a. Calcium silicate insulation
   b. Aluminum preformed jacket
6. Type E-1
   a. Fiberglass board
   b. 3 pounds per cubic foot density
   c. Foil-scrim-kraft facing
   d. Vapor-sealed
7. Type E-2
   a. Fiberglass board
   b. 6 pounds per cubic foot density
   c. Segmented or scored for curved surfaces
8. Type E-3: Flexible cellular foam insulation

B. Application Schedule

Service	Type	Size	Thickness
Refrigerant Piping	P-1A	All	¾ inch

Service	Type	Size	Thickness
Concealed horizontal condensate drains	P-3	All	½ inch

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's instructions

B. Coordinate with work of other trades

C. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness

D. Install insulation where it cannot become wet. If insulation becomes wet, remove, and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.

E. Insulate all piping, valves, fittings, flanges, and accessories.

F. On piping exposed to public view, locate insulation and cover seams in least visible locations

G. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations

H. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation. Do not insulate expansion bellows.

I. Elastomeric Tubing

1. Provide insulation
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations.
3. Apply additional jacket as specified

J. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with

glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

K. Perform work at ambient and equipment temperatures as recommended by adhesive manufacture

L. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost

M. Paint all insulation exposed to ultraviolet light (sunlight); see Paragraph 1.7J.2

N. All vapor barriers shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

O. Joints between insulation and access shall be sealed with vapor barrier mastic

P. See Section 23 31 12 – Ducts

3.3 EQUIPMENT INSULATION

A. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Secure insulation to equipment with bands, welded-on anchors, ties or adhesive. Where access to equipment is required for testing or maintenance the insulation shall be installed so that it is removable and so that the vapor barrier can be remade after access.

B. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

C. For cold equipment or equipment containing fluids below ambient temperature

1. Insulate entire system
2. Provide vapor barrier jackets, factory applied or field applied.
3. Finish with glass cloth and vapor barrier adhesive
4. Cover with aluminum jacket where specified

D. For equipment containing fluids above ambient temperature

1. Insulate entire system
2. Provide standard jackets, with or without vapor barrier, factory applied, or field applied.
3. Finish with glass cloth and adhesive
4. Cover with aluminum jacket where specified
5. For hot equipment containing fluids 140 degrees Fahrenheit or less, do not insulate flanges and unions, but bevel and seal ends of insulation
6. For hot equipment containing fluids over 140 degrees Fahrenheit, insulate flanges and unions with removable sections and jackets

E. Finish insulation at supports, protrusions, and interruptions

F. For equipment in mechanical equipment rooms or in finished spaces, finish with aluminum jacket

G. Do not insulate over nameplate or ASME stamps; bevel and seal insulation around such

H. General

1. Apply insulation with edges tightly butted
   a. Joints staggered and secured in place by steel bands
   b. Where necessary weld on suitable anchors
2. Seal with 520 adhesives.

I. Special considerations

1. Chiller heads: removable and replaceable covers to allow tube removal
2. Strainers and suction diffusers: removable and replaceable covers to allow strainer removal
3. Pumps: removable and replaceable covers to allow impeller replacement
4. Provide sufficient clearance around openings for normal operation of equipment

3.4 DUCT & PLENUM INSULATION

A. Duct Insulation Type and Thickness Schedule

Location	Cooling or Heat/Cool Supply	Heating-only Supply	Return
Outdoors	2 inches 1.5 pounds per cubic foot AL or RAL	2 inches 1.5 pounds per cubic foot AL or RAL	2 inches 1.5 pounds per cubic foot AL or RAL
Concealed in ceiling or return air plenum	1.5 inches DW-V	1.5 inches DW-V	–
In unconditioned spaces	1.5 inches DW-V	1.5 inches DW-V	1.5 inches DW-V
Exposed within conditioned space	–	–	–
Lined duct on drawings (unless otherwise noted)	1 inch 1.5 pounds per cubic foot AL or RAL	1 inch 1.5 pounds per cubic foot AL or RAL	1 inch 1.5 pounds per cubic foot AL or RAL
Terminal cans	0.5 inches 1.5 pounds per cubic foot AL	0.5 inches 1.5 pounds per cubic foot AL	0.5 inches 1.5 pounds per cubic foot AL

Location	Cooling or Heat/Cool Supply	Heating-only Supply	Return
Flex duct	By manufacturer	By manufacturer	By manufacturer

3.5 NON-INSULATED DUCTWORK

A. No insulation required for ducts so indicated in Duct Insulation Type and Thickness Schedule, plus

1. Exhaust ducts, unless shown to be lined
2. Return air ducts in conditioned spaces, unless shown to be lined
3. Outside air ducts

B. Do not line ducts

1. Where prohibited by codes
2. Shower exhaust

3.6 INSULATION INSTALLATION

A. General

1. Ensure that insulation is continuous through inside walls: See 15070 Mechanical Sound, Vibration, and Seismic Control for packing openings through walls
2. Finish insulation neatly at hangers, supports and other protrusions
3. Locate insulation joints or cover seams in least visible locations
4. Where ducts run in groups too close to be individually insulated and finished
   a. Completely fill all spaces between ducts with rigid or flexible insulating material
   b. Insulate and finish exterior surfaces of group as specified for particular service
5. Where ducts cannot be insulated after erection, insulate prior to installation
6. Where specified thickness of insulation and/or lining exceeds available thickness in single layer, provide insulation and/or lining in 2 or more layers with joints staggered
7. Preparation
   a. Do not install covering before ductwork and equipment has been tested and reviewed
   b. Ensure surface is clean and dry prior to installation
   c. Ensure insulation is dry before and during application
8. Mechanical fasteners
   a. Use spot weld anchors in all shop fabricated internally lined ducts
   b. Adhered anchors
   c. Clip off pin penetrations flush with insulation surface or facing
   d. Seal pins and washers where pins penetrate vapor barriers
      1) With 4 inch square pieces of vapor barrier material to match facing
      2) Adhere with vapor seal adhesive
   e. Spacing on rectangular ducts

1) Typical of horizontal and vertical, unless otherwise specified
2) Duct board
   a) 3 inches in from edges
   b) Intermediate fasteners: 12 inches on counter maximum spacing all directions
   c) Not less than four pins per surface
3) Duct wrap

Side Dimension	Maximum Spacing
24 inches and under	None required.
25 to 32 inches	Horizontal - none. Vertical: 1 row centered, 12 inches on center
33 to 48 inches	2 rows, 12 inches on center.
49 to 60 inches	3 rows, 12 inches on center.
61 inches and over	16 inches on center, all directions.

4) Duct wrap spacing applicable to flat surfaces of flat oval ducts

9. Provide 24 gauge sheet metal Z section frames over edges of duct and plenum lining
   a. At access openings and doors
   b. Along edges exposed to air flow

B. Rectangular Duct Wrap

1. Without vapor barrier
   a. Comply with published recommendations of manufacturer and with following
   b. Secure with 4 inch strips of adhesive, 8 inches on center
   c. For rectangular ducts 24 inches and wider, secure to bottom of duct with mechanical fasteners 18 inches on center
   d. Wrap with 18 gauge galvanized wire, 16 inches on center
2. With Vapor Barrier
   a. Vapor barrier and sealing continuous without breaks. Vapor proof seal around supports and bracing
   b. 2 inches lap strip at one end
   c. Peel insulation for 2 inch lap strip along longitudinal joints
   d. Seal lap strips with vapor seal adhesive; Foster's 85-60 or equal

C. Round Duct Wrap

1. General
   a. Adhere flexible insulation to ductwork with adhesive applied in 6 inch wide strips on 16 inch centers
   b. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 16 inch centers
   c. Overlap insulation 2 inches and seal joints and breaks with 2 inch lap of foil adhered over joint
2. Apply duct wrap with vapor barrier as specified above for rectangular ducts

D. Duct Board

1. Comply with published recommendations of manufacturer
2. Secure on top, sides and bottom of duct with mechanical fasteners, spacing as scheduled
3. Secure with 4 inch strips of adhesive, 8 inch on center

E. Rectangular Duct and Plenum Lining

1. Comply with SMACNA Duct Liner Application Standard, published recommendations of manufacturer, and following:
2. Apply adhesive over 100 percent of surfaces to be lined
3. The coated surface shall face air stream
4. Surface adjacent to air flow, including at joints, to be uniformly flat
5. Insulation on floors of plenums and large ducts where access is required shall be protected by wire mesh so that lining is not damaged when walked or crawled on.
6. Blank-Off Panels: Insulation, enclosed with sheet metal on all sides; all joints with vapor barrier mastic and taped
7. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation
8. Seal butt joints and exposed edges of liner to prevent erosion
9. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive
10. Damaged areas replaced or heavily coated with adhesive
11. Mechanical fasteners
    a. Use weld pins
    b. Install mechanical fasteners
        1) Weld pins flush with liner surface. Weld pins spaced maximum of 12-inch on center in both directions and within 2 inches of all corners and joints, except where SMACNA Standard requires closer spacing
        2) Within 2 inches of all edges
        3) Minimum 4 pins per side
        4) For field alterations of lined ducts, install adhesive and glued pins with washers. Clip-off pins after washers installed. Field installed pins shall be used for unusual conditions only and shall not exceed 1 percent of total pins.

3.7 PENETRATIONS THROUGH RATED WALLS

A. Refer to drawings for penetrations of rated assemblies.

B. Install per manufacturer’s installation and listing requirements.

3.8 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

END OF SECTION

SECTION 230800
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Commissioning of selected systems and equipment specified under Division 23 Mechanical

B. Acceptance Testing per California Title 24, Part 6 Building Energy Efficiency Standards

C. Related Sections

1. Section 23 05 93 –Testing, Adjusting and Balancing for HVAC

1.2 COMMISSIONING SCOPE

A. Fully commission the following equipment and systems

1. Fan-coils
2. Air distribution systems
3. Exhaust fans

1.3 TITLE 24 ACCEPTANCE TESTING SCOPE

A. Provide acceptance testing and documentation for the following tests and systems.

1. Constant Volume Systems Outdoor Air Acceptance
   a. All constant volume packaged single zone units
   b. All fan-coil units
2. Air Distribution Acceptance – Duct Construction
   a. All duct systems
3. Air Distribution Acceptance – Duct Leakage Testing
   a. All duct systems

1.4 RESOURCES

A. Provide required personnel with tools and equipment necessary to perform testing specified in this Section.

B. Provide equipment factory representative for startup work as necessary or as specified.

1. For Products specified by association or trade standards, comply with requirements of referenced standard, except when more rigid requirements are specified or are required by applicable codes.
2. Applicable date of each standard is that in effect as of date on proposal or date on Contract where no proposal is available, except when a specific date is specified.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products and materials shall be as described in related sections.

PART 3 - EXECUTION

3.2 GENERAL

A. All tests and readings during the equipment and system start ups shall be recorded with signature of the Contractor's technician performing work and date work was performed.

B. Verify that operational manual/procedures are complete, on-site, and fully reviewed by Contractor's start-up technician prior to start-up and testing.

3.3 START-UP & INITIAL CHECKOUT

A. The Contractor shall follow the start-up and initial checkout procedures specified for each system and piece of equipment.

B. Inspect equipment and confirm that it is clean and ready for operation with all shipping tags and restraints removed.

C. This work shall be performed by the Contractor with the assistance of factory personnel where specified.

D. All tests and readings during the equipment and system start ups shall be recorded with signature of the Contractor's technician performing work and date work was performed.

3.4 COMMISSIONING

A. Participate as a member of the Commissioning Team

1. Commissioning Team, Commissioning Coordinator, Commissioning Schedule, and System/Equipment Matrix are defined in Section 23 0800 – Commissioning of HVAC
2. Assist the Commissioning Coordinator in the creation and maintenance of the Commissioning Schedule and System/Equipment Matrix.
3. Provide regular feedback to the Commissioning Coordinator as to the status of tasks identified in the Commissioning Schedule.
4. Attend Commissioning Team Meetings.

B. Pre-Functional Tests

1. Prepare pre-functional checklists for each piece of equipment and each system listed in Paragraph 1.13 using forms listed at the end of this Section. Where forms are not provided, prepare appropriate forms and submit to the Owner's Representative for review. Contractor may also use their own forms if they are submitted and approved by the Owner's Representative.

2. Verify that pre-functional testing is complete prior to startup.
3. Provide all materials and labor, including testing and inspection, to complete the pre-functional checklists.
4. Collect checklists and submit to the Owner's Representative for review and approval.
5. Address Owner's Representative punch list items before functional testing begins.

C. Startup: Start and test all equipment per manufacturers' installation instructions

D. Testing, Adjusting and Balancing:

1. See Section 23 0593 – Testing, Adjusting and Balancing.
2. Complete test and balance of all air or hydronic systems, including spot checks, with discrepancies and problems remedied before functional testing begins.

E. Functional Testing

1. Review functional test procedures to ensure feasibility, safety and equipment protection and provide revisions deemed to be necessary in writing to Commissioning Coordinator.

3.5 TITLE 24 ACCEPTANCE TESTING

A. The Contractor shall be responsible for providing all necessary instrumentation, measurement, and monitoring, and performing all required acceptance requirement procedures in accordance with Title 24 Building Energy Efficiency Standards and Appendix NJ of the Title 24 Non-Residential ACM Manual.

B. The Contractor shall be responsible for correcting all performance deficiencies and again implementing the acceptance requirement procedures until all specified systems and equipment are performing in accordance with the Standards.

C. The Contractor shall be responsible for documenting the results of the acceptance requirement procedures including paper and electronic copies of all measurement and monitoring results. The Contractor shall be responsible for performing data analysis, calculation of performance indices and crosschecking results with the requirements of the Standard.

D. The Contractor shall be responsible for preparing and issuing a Certificate of Acceptance for each test for each system. Each Certificate of Acceptance shall include the Contractor's signature and California License number.

E. For test procedures, see Appendix NJ of the Title 24 Non-Residential ACM Manual. For test forms, see the 2005 Nonresidential Compliance Manual. Both are available at: http://www.energy.ca.gov/title24/2005standards/index.html

3.6 TRAINING

A. General:

1. Comply with Training section in Division 1.
2. Training shall cover all systems and equipment that require expertise to operate and maintain including but not limited to training specified under individual Division 15 Sections.

B. Training Sessions

1. Engage a qualified trade or manufacturer's representative to provide the instructions on each major piece of equipment. This trainer may be the start-up technician for the piece of equipment, the installing contractor, or a manufacturer's representative. Where required by individual Division 23 Sections, trainers shall be factory-trained and authorized. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.
2. Start training with classroom sessions followed by hands-on training on each piece of equipment.
    a. Classroom training shall use slides, drawings, and O&M manuals to cover as a minimum:
        1) The equipment's specific location in the building and in the mechanical system
        2) Purpose and mechanical function of the equipment
        3) A brief working knowledge of the operating theory of the equipment
        4) Submittal drawings, catalog data, and O&M manual content and organization
        5) Available parts lists, including recommendations regarding parts that should be readily available and stored on site
        6) Local representatives for service, parts, and repair, including contact information
        7) Startup, shutdown, normal operation, and emergency operating procedures
        8) Safety and emergency procedures including proper precautions when around equipment
        9) Daily, weekly, monthly, quarterly, semiannual and annual routine preventative maintenance requirements and procedures
        10) Required equipment exercise procedures and intervals
        11) Normal and major repair procedures
        12) Equipment inspection and troubleshooting procedures including the use of applicable test instruments
        13) Routine and long-term calibration procedures
    b. Hands-on training shall be on-site and use O&M manuals as a guide to cover as a minimum:
        1) Location of equipment
        2) Piping connections and flow directions
        3) Valves, including control and flow balancing valves, and their purpose
        4) Instrumentation and controls, and interpretation of displayed information
        5) Perform startup and shutdown procedures
        6) Identify location of all related equipment power disconnect switches, fuses and circuit breakers
        7) Perform required equipment exercise procedures
        8) Demonstrate and perform standard operating procedures and checks

9) Perform routine preventative maintenance activities including mechanical and electrical adjustments and calibration
10) Perform routine disassembly and assembly of equipment if applicable
11) Identify and review safety items and perform safety procedures

C. Training Duration and Schedule

1. The length and quantity of training sessions will depend on the complexity of the system and equipment. Minimum training shall be 40 hours, but period shall be longer if required to complete the training tasks described herein and in individual Division 23 Sections.
2. Training sessions shall be scheduled with classroom sessions interspersed with hands-on field instruction in logical sequence.
3. Unless otherwise approved by Owner's Representative, training for a given system or piece of equipment shall be conducted on consecutive days with no more than 6 hours of training scheduled for any one day.
4. Training Plan Submittals & Timing
   a. Develop a preliminary training plan outline and schedule of training dates and submit to the Owner's Representative for review and approval a minimum of 60 days before the planned training sessions.
   b. Once the training plan outline is approved, submit one complete set of lesson plans, training manuals, handouts, visual aids and reference material organized in tabbed binder(s) to the Owner's Representative for review and approval a minimum of 30 days before the planned training sessions.
   c. Provide training materials to Owner's Representative 7 days before the planned training sessions. Provide one set of materials for each trainee as directed by Owner, up to a maximum of 10 copies. Additional copies shall be provided at the cost of reproduction without mark-up if requested by Owner's Representative.
5. Provide final training materials in electronic format.

3.7 COMMISSIONING REPORTS

A. For each piece of equipment or system listed in paragraph 1.13 of this Section, provide the following where applicable

1. Duct Pressure Test Reports. See Section 23 3112 – Ducts
2. Pre-Functional Test Reports
3. Start-up and Factory Test Reports
4. Testing, Adjusting, and Balancing Report. See Section 23 0593 – Testing, Adjusting and Balancing
5. Training Manuals: See Division 1 – Training

B. Provide reports to Owner's Representative in quantities and format specified in Section 23 08 00 – Commissioning of HVAC.

PUMP PRE-FUNCTIONAL TEST DATA SHEET PUMP TAG _____

DUCT SYSTEM PRE-FUNCTIONAL TEST DATA SHEET

DUCT SYSTEM NAME _____

DUCT SYSTEM DATA				
	AS DESIGNED	AS FOUND/ TESTED	ACTION REQUIRED	DONE
DUCT MATERIAL				
INSULATION MATERIAL				
INSULATION THICKNESS				
LEAKAGE TEST PRESSURE				
PRESSURE TEST FAN Hz				
INSTALLATION				
		AS FOUND	ACTION REQUIRED	DONE
SPRING HANGERS WHERE SPECIFIED				
SEISMIC SUPPORTS INSTALLED PER SPEC'S				
LONGITUDINAL DUCT JOINTS SEALED				
TRANSVERSE DUCT JOINTS SEALED				
DUCT PENETRATIONS SEALED				
DUCT INSULATION COMPLETED AND VAPOR BARRIERS SEALED				
FLEXIBLE DUCT CONNECTIONS INSTALLED PROPERLY				
FLEXIBLE DUCTS INSTALLED WITH NO KINKS				
MANUAL DAMPERS LEFT OPEN PRIOR TO BALANCE				
DUCT PRESSURE TESTS PERFORMED AND PASSED				
DUCT LEAKAGE TESTS PERFORMED AND PASSED				
AS FOUND CHECKED BY			DATE:	
REMEDIAL ACTION CHECKED BY			DATE:	

FAN COIL UNITS PRE-FUNCTIONAL TEST DATA SHEET UNIT TAG _____

FAN COIL UNITS DATA				
	AS DESIGNED	AS FOUND	ACTION REQUIRED	DONE
MANUFACTURER				
MODEL NO. / SIZE				
SERIAL NO.				
VIBRATION ISOL MANUF.				
VIBRATION ISOLATION TYPE/DEFLECTION				
MOTOR DATA (FAN POWERED)				
	AS DESIGNED	AS FOUND	ACTION REQUIRED	DONE
MANUFACTURER/MODEL				
SERIAL NO.				
TYPE				
H.P./RPM				
VOLTS/PHASE				

END OF SECTION

SECTION 230900
INSTRUMENTATION & CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. General:

1. Provide labor, equipment, and materials for a complete installation and property operating control system. Temperature control systems shall be designed and provided by temperature control contractor, Automatic Control & Engineering, Inc., Johnson Controls, or equal. Provide complete engineering/detailed control drawings showing all devices, terminal numbers, schedules, legends, labels, etc., as required to properly display the systems to be installed and to allow easy troubleshooting in the future. The diagrams shall also indicate set points, throttling range, integral setting, ratios, and all other switch settings and adjustments.
2. Apartment Thermostat Garden/High-density Wood Frame: Honeywell Pro 2000 Programmable thermostats. Mount thermostats at 46" max. to the top.
3. Common Area Thermostats Provide lock boxes over common area thermostats.

1.2 ELECTRICAL CHARACTERISTICS

A. General:

1. Automatic temperature controls, control and instrumentation equipment, automation equipment, and installation of electric/electronic control. Provide system of controls that will completely accomplish implied or intended functions of control system as shown on Drawings and as specified.

1.3 SUBMITTALS

A. Include manufacturer's certified rating data, description literature, catalog cuts, and shop drawings, for proposed:

1. Control devices and equipment.
2. Control dampers and valves.
3. Control panels.
4. Programmable Thermostat.

B. Include control and interlock wiring diagrams and descriptions on operation of all control systems and their effect on other equipment and systems.

C. A review of any submittal, which results in a requirement for Contractor to resubmit, shall not be justified basis for work delay or additional compensation.

D. Arrange a non-disclosure agreement with the manufacturers to permit the Owner to obtain and use documentation on the system of software.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Honeywell.

B. Johnson Controls.

C. KELE.

D. Or Equal.

2.2 MATERIALS

A. It is the intention of this portion of the specifications to set a minimum standard of quality for all equipment and devices used in the control system and at the various control panels. All hardware employed within this system shall be of the "first quality" grade. Equipment shall be selected on the basis of durability, serviceability and function. Provide only UL listed equipment.

B. The equipment furnished under this section of the specifications shall be supplied as a complete system produced under the responsibility of the controls contractor utilizing all the various components specified to meet the function and accuracies described within this section of the specifications.

C. All conduit required for controls shall be furnished and installed by the controls contractor. All wiring required for controls shall be furnished and installed by the controls contractor.

2.3 AUTOMATIC TEMPERATURE CONTROL EQUIPMENT

A. Programmable Thermostats:

All programmable thermostats are required to have the capability to be programmed for temperature operation in the occupied mode and the unoccupied mode. Separate heating and cooling set points and auto-changeover capability allow occupied and unoccupied programming for extreme temperature control and for energy savings.

The occupied mode is required to be activated before heating and cooling set points can be maintained.

Both the heating and cooling set points shall be independently adjustable in such a manner that the temperature difference between heating and cooling set points develops an energy dead band of 5 degrees. When the space temperature is within the dead band, neither heating nor cooling energy is added to the space. The supply fan runs continuously during occupied mode.

B. Electric solid state microcomputer based wall mounted room thermostat, located as indicated at a height of 46 inches to top above the floor.

C. Room thermostat shall incorporate:

1. Automatic switching from cooling to heating.
2. Short cycle protection.

3. Programming based on weekdays, Saturday, and Sunday.
4. Switch selection features including fan-on auto switch.

D. Protective Guards: Provide on all controllers or transmitters in corridors, lobbies, meeting rooms, common areas accessible to all residents, instruction rooms and similar areas with vandal proof screws and finished in clear plastic.

E. Smoke Detectors: Powered by Division 16 furnished and installed in ducts or equipment by Division 15.

F. Electrical Wiring: Beyond that furnished under Division 16, provide herein as necessary to accomplish the intent and operations called out. All conduit required for controls shall be furnished and installed by the controls contractor. All wiring required for controls shall be furnished and installed by the controls contractor.

G. Nameplates: Secure to all switches, indicating lights and control devices (self-tapping screws or bolts) to identify the items. Provide engraved laminated plastic, black nameplates with white letters.

2.4 TRAINING

A. Provide two hours of operation and maintenance training for Owner's personnel.

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 232155
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

1.2 RELATED SECTIONS

A. Section 23 81 26 – Split System Air Conditioners.

1.3 REFERENCES

A. UL - Underwriters Laboratory.

1.4 SUBMITTALS

A. Include product data on pipe materials, pipe fittings, valves and accessories.

B. Include schedule indicating manufacturer, model number, size, location, rated capacity and features for each specialty.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until use.

PART 2 - PRODUCTS

2.1 PIPING

A. Copper Tubing: Type ACR, hard drawn.

1. Fittings: Wrought copper with long radius elbows.
2. Joints: Solder, Grade 95TA.

2.2 REFRIGERANT

A. R-410A.

2.3 MOISTURE AND LIQUID INDICATORS

A. Single port type, UL listed with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap.

2.4 REFRIGERANT FILTER DRIER

A. One direction flow for air conditioners with molded porous core to remove moisture and foreign matter from the refrigerant stream.

2.5 VALVES

A. Diaphragm Packless Valves (Sizes 1-1/8 Inch and Smaller): UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends with positive back-seating; for maximum working pressure of 500 pounds per square inch and maximum temperature of 275 degrees F.

B. Packed Angle Valves (Sizes Over 1-1/8 Inch): Forged brass, forged brass seal caps with copper gasket, rising stem and seat with back-seating, molded stem packing, solder, or flared ends; for maximum working pressure of 500 pounds per square inch and maximum temperature of 275 degrees F.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs and clean joints bright with fine sandpaper and steel wool.

B. Remove scale and dirt on inside and outside before assembly.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in an orderly manner, plumb and parallel to building structure and maintain gradient. Install piping in accordance with the recommendations of the refrigeration equipment manufacturer, including pipe sizes, refrigerant system evacuation and leak testing.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping 1 percent in direction of oil return.

E. Provide non conducting dielectric connections when joining dissimilar metals.

F. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access to concealed valves and fittings.

I. Prepare pipe, fittings, supports and accessories not prefinished ready for finish painting.

J. Insulate all liquid and suction piping.

3.3 APPLICATION

A. Provide line size liquid indicators in main liquid line leaving condenser, or if receiver is provided, in liquid line leaving receiver.

B. Provide replaceable cartridge filter driers vertically in liquid line adjacent to receivers with three valve bypass assembly to permit isolation of driers for servicing.

C. Provide refrigerant charging (packed angle) valve connections in liquid line between receiver shut off valve and expansion valve.

D. Utilize flexible connectors at or near compressors where piping configuration does not absorb vibration.

END OF SECTION

SECTION 233117
DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Ductwork
2. Plenums
3. Fasteners and Sealants
4. Exceptions: Where integral with manufactured piece of equipment

B. Related Sections

1. Section 23 00 50 – Basic Mechanical Materials and Methods
2. Section 23 08 00 – Commissioning of HVAC.

1.2 REFERENCE STANDARDS

A. SMACNA HVAC Duct Construction Standards, latest edition

1.3 DEFINITIONS

B. Seam: locks or weld applied longitudinally to close section of duct, for example longitudinal seam, spiral seam.

C. Joint: abutting connection between duct sections for continuity of air passage, for example cross joint, transverse joint, coupling.

D. Reinforcement: hardware applied to strengthen duct, for example girth angles, tie rods, fasteners (not connectors), and the like.

E. Stiffening: folding, bending, beading, cross breaking or corrugating of sheets to achieve strength through shape, for example pocket lock secures joint and is transverse stiffener, with girth angle and fasteners applied (not connectors), joint or stiffener is reinforced.

F. Duct Classification

1. Velocity
   a. Low: to 1750 feet per minute
   b. High: above 1750 feet per minute

2. Pressure classification: except as indicated on the Drawings
   a. Low: to 2 inches water gage
   b. Medium: above 2 inches to 6 inches water gageUL - Underwriters Laboratory.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements

1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A
2. Ductwork and components shall be listed as U.L. 181, 181A and 181B, Class I air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Spiral oval and round ducts

1. United Sheet Metal Division, United McGill
2. Semco Manufacturing, Inc.
3. Metco
4. Contractor fabricated
5. Or equal

C. Duct Connection Systems

1. Ductmate Industries, Inc.
2. Fabriduct Transverse Duct Connection system
3. Ward Industries, Inc.
4. Or equal

D. Flexible Connections

1. Ventfabrics
2. Duro Dyne
3. Or equal

E. Flexible Ducts

1. Thermaflex
2. ATCO Rubber Products, Inc.
3. Hart & Cooley

F. Or equal

G. Duct Sealants

1. Minnesota Mining and Manufacturing Company
2. Foster Products Corporation
3. Miracle Adhesive Corporation

4. United Sheet Metal Division United McGill Corporation
5. Hardcast Corporation, Inc.
6. Mon Eco Industries
7. Nashua
8. 3M
9. Or equal

H. Flexible Duct Clamps

1. Panduit
2. Aeroquip Corporation
3. Ideal Division Parker Hannifin Corporation
4. Tridon Corporation
5. Young Regulator Company
6. Or equal

I. Spin-in Fittings

1. Young & Company, Manufacturing
2. Modular Metals
3. Or equal

J. Flue

1. Selkirk Metalbestos
2. Ampco
3. Metal-Fab, Inc.
4. American Metal Products Amerivent
5. Simpson Dura-Vent
6. Or equal

2.2 MATERIALS

A. Galvanized Steel Sheet Metal

1. Cold rolled soft steel sheets
2. ASTM 526-64T
3. Galvanizing: 1-1/4 ounces per square foot, total both sides
4. Lock-forming quality

B. Miscellaneous Products

1. Screws and rivets
   a. Same material as sheet, except as indicated on the Drawings
   b. On aluminum sheets, provide cadmium plated or stainless steel
   c. Zinc or cadmium plated, permitted on galvanized sheets
   d. Minimum screw size: No. 10
   e. Minimum rivet size: 4 pound

2. Duct Sealants

a. Sealing compound: Safetee Duct Sealant 32-17, Foster Products Corporation, Design Polymerics DP-1010, or equal
b. Tape: Nashua or equal, comply with UL 181B
c. Gaskets
    1) Continuous, reinforced, inert self-conforming type
    2) 1/8 inch thick
    3) Width: to match angle connection.
    4) 3M Weatherban Ribbon Sealant PF5422 or equal

3. Hard-setting joint tape, two-part
    a. Two part tape
    b. Mineral impregnated woven fiber tape
    c. Impregnated with activator/adhesive of polyvinyl acetate type
    d. UL Listed
    e. Flame spread: 10
    f. Smoke contributed: 0
    g. Equal to Hardcast RTA-50 sealant and DT-5400 4 inch tape

4. Spring Fasteners
    a. Oval head stud and receptacle
    b. Screwdriver slot
    c. Self-ejecting
    d. Dzus or equal

5. Angles, tie rod and shapes for reinforcing ducts: In accordance with SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings

6. Duct connection system
    a. Transverse bolted duct joints
    b. Flanges with permanent, non-hardening sealant
    c. Ductmate Industries Ductmate 25 and 35, Fabriduct TDC, or equal

C. Flexible Connections

1. Conforming to UL Standard No. 214 and NFPA 90A

2. SMACNA HVAC Duct Construction Standards, except as indicated on the Drawings

3. With metal edges at each end: No. 24 USSG galvanized steel

4. Length of fabric connections
    a. Minimum: 4 inch
    b. Maximum: 10 inch

5. Materials
    a. Coated glass fabric
    b. Flame spread rating: 25
    c. Smoke development rating: 50
    d. 30 ounces per sq yard
    e. Sewed and cemented seams

f. Indoors
    1) Neoprene
    2) Ventfabrics, Inc. Ventglas or equal
g. Outdoors
    1) Weather-resistant
    2) Fiberglass with Hypalon
    3) UV, sunlight, and ozone resistant
    4) Ventfabrics, Inc. Ventlon or equal
h. Fume Hood
    1) Fabric coated with Teflon fluorocarbon resins
    2) Meets UL Standard #214 for flammability and NFPA 102 requirements
    3) Ventfabrics, Inc. Ventel or equal

D. Turning vanes

1. Galvanized steel ductwork: galvanized steel or painted black steel, except as indicated on the Drawings

2. Other ductwork: same material as ductwork

3. Construction per SMACNA HVAC Duct Construction Standards for
    a. Single wall vanes with 3/4 inch trailing edge
    b. Double wall vanes: Not acceptable
    c. Vane length: Provide separate equal size sections for vane length greater than those indicated in referenced Standards.
    d. Vane runners: Type 1 or 2 acceptable

4. Vane radius
    a. 2 inch radius: duct width up to 36 inches
    b. 4-1/2 inch radius: duct with 36 inches or larger

E. Low pressure round duct take-off fittings in rectangular duct

1. Factory-fabricated spin-in fitting

2. Die-formed galvanized steel

3. Balancing damper
    a. Spring loaded
    b. Locking regulator
    c. Sealed at both ends to prevent leakage
    d. No scoop allowed for any application
    e. Noll Manufacturing, Young Manufacturing or equal

2.3 ROUND AND OVAL DUCTWORK

A. General

1. Factory- or shop-fabricated spiral lock seam duct
    a. No snap lock

b. Factory-fabricated longitudinal seam acceptable for ducts larger than standard factory sizes

2. Fittings
   a. Same material and construction as duct in which installed
   b. For ductwork exposed to occupant view, do not use fabricated fitting at taps to VAV boxes and outlets. Instead use saddle tap cut into continuous spiral duct. Intent is for spiral duct to be continuous for aesthetic reasons.
   c. Tees
      1) 45 degree conical tap
      2) Center-line take-off, unless otherwise indicated on the Drawings
   d. Elbows
      1) Seams
         a) 4 inch and higher pressure class and all ducts exposed to occupant view: continuously welded seams
         b) 1 inch to 3 inch pressure: spot welded with bonded seams
         c) Adjustable elbows with sealed gores acceptable 1 inch pressure class and below and where concealed from occupant view
      2) Gores
         a) 2 gores - less than 35 degrees
         b) 3 gores - 36 degrees through 71 degrees
         c) 5 gores - over 71 degrees

2.4 FLEXIBLE DUCTS

A. Flexible ducts

1. Use only where indicated on the Drawings

2. UL 181, Class I Air Duct

3. Labeled for compliance with CMC

4. Minimum working pressure
   a. 0 to 4 inch positive static pressure class: 4 inches
   b. 0 to 1 inch negative static pressure class: 1 inch

5. Insulated Flexible Duct
   a. Chlorinated polyethylene (CPE) inner liner duct permanently bonded to a vinyl or zinc coated spring steel wire helix
   b. Fiberglass insulating blanket; minimum R-value
      1) Ducts outside the conditioned space and in conditioned envelope: 4.2
      2) Ducts outside conditioned space and conditioned envelope: 8.0
   c. Low permeability outer vapor barrier of fiberglass bi-directional reinforced metallized film laminate
   d. Thermaflex M-KE or equal

6. Uninsulated Flexible Duct
   a. Woven fiberglass fabric with flame retardant coating permanently bonded to a vinyl or zinc coated spring steel wire helix
   b. Thermaflex S-LP-10 or equal

B. Flexible ductwork clamps

1. Straps listed for use with flexible ductwork

2. 2 inches and greater SP Class: Galvanized steel strap
   a. Adjustable toggle type
   b. Young Quick-Clamps or equal

3. Less than 2 inches SP class: Adjustable nylon strap
   a. With factory furnished installed tool
   b. Panduit PAN-TY Cable Ties, Heat Stabilized Nylon 6/6

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. See Section 23 09 00 – Energy Management & Control Systems

C. See Section 23 08 00 – Commissioning of HVAC

3.2 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

3.3 DUCT CLASSIFICATION

A. Minimum operating pressure for each duct system, general

1. Scheduled static pressure for each fan or unit, positive or negative, unless otherwise indicated on the Drawings

2. Adjust upward to nearest pressure class tabulated in SMACNA HVAC Duct Construction Standards

B. Static pressure class, unless otherwise indicated on the Drawings

Application	SMACNA Pressure Class
Discharge of air handlers through shaft fire/smoke damper	3 inches
Air distribution duct on each floor	2 inches
Toilet exhaust	-2 inches
Other fans systems	Per fan static
Return air transfers	1/2 inch

3.4 DUCTWORK INSTALLATION

A. General

1. Install ducts in accordance with manufacturer's written installation instructions

2. Ductwork exposed to occupant view shall be run straight and true, in line with building elements. No sagging or out-of-true straight runs shall be acceptable. Sidewall taps and duct joints shall be clean and free of visual blemishes. Ducts shall have no external markings or tags.

3. Construct with gages, joints, bracing, reinforcing, and other details per latest CMC, ASHRAE, SMACNA and NFPA, unless specified otherwise
   a. Comply with most stringent
   b. Provide ducts with CMC gages or thicker when traversing rated corridors

4. Construct of galvanized sheet metal, except where otherwise indicated herein or on Drawings

5. Provide for duct rigidity by either of these methods
   a. Beading at 12 inches on center, maximum
   b. Crossbreak outward in ducts having positive internal pressure
   c. Crossbreak inward in ducts having negative internal pressure
      1) Exception: All ducts exposed to rain shall outward crossbreak on top of the duct.

6. Duct dimensions indicated are outside duct dimensions (OD) unless indicated on the Drawings as inside dimension (ID or net, clear dimension).

7. Alter duct sizes on basis of equal friction where required to facilitate installation. Reflect changes in shop drawings for review by Owner's Representative.

8. At duct penetrations of walls, floors and ceilings where exposed to occupant view, provide sheet metal angle type escutcheons with no sharp corners or edges.
   a. Clearance from duct to opening shall not exceed 2 inches
   b. Escutcheons shall overlap wall, floor, or ceiling surface by ½ inch minimum

9. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions

10. Tapers
    a. Pitch sides of duct in diverging or converging airflow maximum of 1 to 4 taper
    b. Abrupt, bushing type fitting not allowed

11. Duct openings
    a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, and the like. Insert through airtight rubber grommets.
    b. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material inside metal ring for use as plug.
    c. At fire dampers allow adequate length of duct to install access door.

12. Avoid penetration of ducts; provide airtight seal at unavoidable penetrations of hanger rods

13. No exposed sharp metal allowed
    a. All exposed pins, screws and sharp objects shall be covered with hardening silicon
    b. All exposed sheet metal edges shall be hemmed with exposed corners rounded smooth
    c. Remove all sheet metal fish hooks

14. Install lining in ducts and plenums as specified in Section 23 0700 – HVAC Insulation.

15. Flexible Connections
    a. Coated glass fabric
    b. For indoor or outdoor use
    c. Use diaphragm type at plug fan inlets
    d. Install at connections to fans and air handling units and as indicated on Drawings
    e. 2 inch slack in fabric; install to allow minimum movement of 1 inch in both tension and compression
    f. Protect from direct solar and rain exposure with sheet metal shroud where outdoors

16. Volume dampers: Install dampers as specified in Section 23 3300 – Duct Accessories

B. Elbows and Splits

1. Use radius elbows in rectangular ducts unless otherwise indicated on the Drawings: Centerline radius dimension shall not be less than 1-1/2 duct width

2. Where space does not permit duct radius specified above install short radius splitter vanes per SMACNA HVAC Duct Construction Standard
    a. Number of vanes determined by ratio of inner radius (R) to duct width in plane of radius (W)
    b. One vane: Radius to width ratio above 0.3
    c. Two vanes: Radius to width ratio between 0.1 to 0.3
    d. Three vanes: Radius to width ratio 0.1 and smaller

3. Use square turns with turning vanes in rectangular ductwork, unless otherwise indicated on the Drawings, at following locations
    a. Use only where full radius elbow cannot fit
    b. Use only in ducts with 2000 fpm or less design velocity
    c. In medium pressure ductwork spot weld turning vane to duct

C. Rectangular Duct Joints

1. Transverse Joints
    a. In medium pressure ductwork shall be Fabriduct TDC or Ductmate or equal
    b. In low pressure ductwork shall be Fabriduct TDC or equal except that ducts under 19 inches longest side may be slip & drive (S&D)

2. Longitudinal seams shall be Pittsburgh. Snap lock not allowed

D. Round and oval ductwork

1. Joints between ducts
    a. Made with beaded sleeve joints as scheduled
    b. Duct sealer applied to male end
    c. Mechanically fastened with sheet metal screws or pop rivets
    d. Over joint and screw or rivet heads, apply coating of duct sealer.
        1) Duct where exposed to occupant view: Sealant shall be within joint only and not visible

2. Joints, duct and fitting
    a. Slip projecting collar of fittings into duct: Per SMACNA HVAC Duct Construction Standard
    b. Apply duct sealer: Seal and tape as specified above
    c. Mechanically fasten: Fastening schedule: Per SMACNA HVAC Duct Construction Standard

3. Junctions between ducts
    a. Branch take-off: 45 degrees or conical 90 degrees
    b. Branch connections to low pressure rectangular ducts may be made with spin-in fittings

4. Horizontal supports
    a. One or two piece clamp band strap
    b. Minimum: one per section
    c. Support fittings as required to prevent sagging

5. Vertical Supports: one of the following
    a. Clamp bands with extended ends supported by floor
    b. Clamp bands with knee bracing
    c. Pedestal at base of vertical

E. Flexible ductwork

1. Continuous, single pieces

2. Length
    a. Medium and high pressure: Not allowed
    b. Low pressure
        1) Maximum 7 feet, except where longer lengths are indicated on drawings. Where longer lengths are shown, the last 3 feet to 7 feet shall be wire flex duct and remaining ductwork shall be aluminum flex duct.
        2) Minimum length: 3 feet

3. End Connections
    a. Connect to duct collars, terminal unit connections and round air outlets per manufacturer's instructions
    b. Secure with strap clamps specified above

4. Installation
    a. Support adequately to avoid excessive droop

b. Minimum inside bending radius not less than one duct diameter
c. Install as straight as possible except as shown on drawings for sound attenuation
d. Cut ducts to lengths required rather than create bends to take up excess lengths except as shown on drawings for sound attenuation

F. Grille connections

1. Provide at entry to diffuser collar either
   a. Straight duct for 1 duct diameters or greater
   b. Full radius elbow
   c. Side inlet plenum
      1) Height: 4 inches minimum taller than top of grille to provide room for uniform airflow to grille
      2) Width/length: 2 inches wider than duct or round diffuser collar, whichever is larger
      3) Internal surfaces lined with minimum 1/2 inch thick Type AL duct liner as specified under Section 23 0700 – HVAC Insulation
      4) At contractor's option, where plenum is required at round neck diffuser, square neck diffuser with length and width equal to diffuser diameter may be substituted
   d. Thermaflex FlexFlow Elbow or equal

2. Connections at grilles shall be insulated to the extent the duct is insulated including the final register box.

3. Seal connections at grilles per seal class of upstream ductwork.

G. Duct hangers and supports

1. General
   a. Support horizontal ducts with hangers of size and spacing as indicated in pertinent SMACNA HVAC Duct Construction Standards
   b. Attachment to structure: See Section 23 0529 – Hangers and Supports
   c. Seismic restraints: See Section 23 0548 Vibration and Seismic Controls for HVAC Piping and Equipment.

2. Horizontal Duct Supports
   a. Install hangers at each change in direction of duct
   b. Strap hangers
      1) Extend strap down both sides of ducts
      2) Turn under bottom one inch minimum
      3) Metal screw hangers to
         a) Bottom of duct
         b) Upper and lower sides of ducts
         c) Not more than 12 inches on center
   c. Angle hangers
      1) Provide angle hangers formed by extended vertical bracing angles
      2) Or by rods connecting to bottom angles if size or bracing angles conform to hanger schedule
   d. Vertical duct supports

1) Support vertical ducts at every floor
2) Use angles or channels mechanically fastened to ducts with screws or pop rivets.
3) Set angles or channels on floor slab or structural steel members placed in opening, unless otherwise indicated on the Drawings

H. Ducts exposed to weather

1. Make ducts subject to rain watertight.
2. Construct as follows to assure water run-off
   a. Arrange standing seams to not act as dams
   b. Longitudinal seams at bottom of duct
   c. Construct all ducts subject to rain watertight and to insure water runoff by one or more of following techniques
      1) Slope entire top of duct down toward side.
      2) Vertical struts within duct to bow top panels of duct into convex shape
3. Seal as specified herein.

I. Sound-rated duct packing

1. Wherever possible avoid duct penetrations through sound-rated walls, floors and ceilings.
2. Provide packing for unavoidable duct penetrations per Section 15070 Mechanical Sound, Vibration, and Seismic Control.

J. Joint Sealing

1. Seal ducts per the Seal Levels tables below
   a. Provide more stringent sealing if required to meet requirements of Paragraph 3.6 and 3.7.

Seal Level Requirement				
Duct Location	Duct Type			
	Supply		Exhaust	Return
	≤2 in. water column[b]	>2 in. water column[b]		
Outdoors	A	A	C	A
Unconditioned Spaces	A	A	C	A
Return Air Plenums	A	A	A	C
Conditioned Spaces	C	A	A	C

[b]Duct design static pressure classification.

Seal Level Definitions	
Seal Level	Sealing Requirements
A	All transverse joints, longitudinal seams, and duct wall penetrations
B	All transverse joints and longitudinal seams
C	Transverse joints only

Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps and other branch connections, access door frames and jambs, duct connections to equipment, etc.

2. Ducts not exposed to weather: Seal using one of the following:
   a. Duct sealer per Paragraph 2.2D.2.a
   b. Gasketted TDC or Duct-Mate
   c. Flexible duct
      1) Secure with straps or clamps as specified herein.
      2) Supplement with duct tape, both inner and outer liner.

3. Duct exposed to weather

   a. TDC or Duct-Mate joints: Utilize interior joint gasket material plus a bead of butyl rubber sealant at the joint and continuous metal clip or cleat over the top of all four joints (top bottom and sides).

   b. Apply two part hard-setting joint tape to
      1) Horizontal joints
      2) Transverse joints
      3) TDC or Duct-Mate joints
      4) Duct penetrations
      5) Screws through duct

4. Indoor duct where exposed to occupant view: Sealant shall be within joint only and not visible
5. Fire and fire/smoke dampers: Sealant shall be listed as approved on manufacturer's UL installation sheet.
6. Seal punched holes and corner cracks
7. Seal all factory fabricated ducts, including transverse joints on gored elbows
8. Seal end caps
9. After installation and testing reseal joints found to be leaking at no additional cost to the Owner. See Paragraph 3.7.

3.5 DUCT PRESSURE TESTING

A. Scope of Testing

1. HVAC Ductwork and Plenums
   a. Supply
      1) Test only 2-inch pressure class and greater Standard 90.1 requires 3 inches and above.
      2) Test representative sections totaling no less than 25% of the total installed duct area for the designated pressure class in each system: Duct sections to be tested are to be chosen by Owner's Representative. Do not proceed with tests until test sections are designated.
      3) Test field installed supply fan plenums
   b. Return: Not required
   c. Exhaust: Not required
   d. Outdoor air: Not required

B. General

1. Tests conducted in presence of Owner's Representative
2. Use portable high pressure blower and necessary instruments to indicate amount of leakage
3. See Section 23 0593 Testing, Adjusting and Balancing for testing procedures and accuracy of test instruments
4. Conduct tests as prescribed in SMACNA HVAC Air Duct Leakage Test Manual, and make test before duct sections are concealed
5. Procedure
   a. Seal openings in ducts and plenums to be tested.
   b. Connect test apparatus to test section using flexible duct connection or hose.
   c. Close damper on blower suction side, to prevent excessive buildup of pressure.
   d. Start blower and gradually open damper on suction side of blower.
   e. Build up pressure in test section equal to static pressure class.
   f. Noise generated from duct leakage not acceptable. Seal as required.
   g. Determine amount of air leakage by makeup air flow measurements:
      1) Maximum permitted leakage for HVAC ductwork shall be:
      CFMmax = (A/100) CL P0.65
      where
      CFMmax = the maximum permitted leakage, cubic feet per minute (cfm).
      A = surface area of the tested duct sections, square feet.

CL = duct leakage class, cfm/100 square feet at 1 inch water column.
= 6 for rectangular sheet metal, rectangular fibrous ducts, and round flexible ducts
= 3 for round/flat oval sheet metal or fibrous glass ducts
P = test pressure which shall be equal to the design duct pressure class rating, inches water column.

2) Maximum permitted leakage for life safety ductwork shall be per CMC 905.
3) If leakage exceeds allowable limit, expand testing to include 100% of duct system at no additional cost to the Owner.
4) If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Owner until permitted leakage limits are obtained.

6. Visually mark tested sections with certification sticker and initials of field test inspector.

C. Documentation

1. Submit certification of test results of compliance to Commissioning Authority.
2. Include certified test results showing compliance per Section 23 0050 – Basic Mechanical Materials and Methods.

3.6 SYSTEM LEAK TESTING

A. Scope of Testing

1. Supply: Systems greater than 5,000 cfm design capacity
2. Return: Not required
3. Exhaust: Systems greater than 10,000 cfm design capacity
4. Outdoor air: Not required

5. Seal Class B and C ducts not required to be tested

B. General

1. See Section 23 0593 – Testing, Adjusting and Balancing for testing procedures and accuracy of test instruments
2. Tests shall be done after air balancing; see 230593 – Testing, Adjusting and Balancing
3. Determine the maximum allowable leakage per system using the methodology in Paragraph 3.6B.5.g. The duct surface area shall be all ductwork downstream of the fan through the air outlets.

C. Test conditions

1. Fan balance complete and operating at design airflow conditions
2. For variable volume fans, set all the variable volume boxes to design maximum airflow rates and operate the fan at optimum static pressure setpoint; (see

230593 Testing, Adjusting and Balancing); fan and boxes to remain in a static state during the testing

D. Leakage testing

1. Collect the following information from air balance reports for each tested fan system. (This work is already required in Section 23 0593 Testing, Adjusting and Balancing, so no new work is required.)
   a. Pitot traverse in the supply (exhaust) duct downstream, positive pressure side (downstream, negative pressure side) of the fan, and
   b. Totaling the readings of individual air outlets or terminals

2. Subtract the readings in Paragraph 3.7D.1. If the difference in the readings, accounting for the accuracy of the test instruments, is greater than the amount allowed in Paragraph 3.7B.3, repair air leaks as required and retest.
3. If leakage exceeds permitted limit, repair leaks and retest duct sections at no additional cost to the Owner until permitted leakage limits are obtained.

E. Documentation

1. Submit certification of test results of compliance to Commissioning Authority

2. Include certified test results showing compliance per Section 23 0050 – Basic Mechanical Materials and Methods

3.7 PROTECTION

A. Adhere to SMACNA Duct Cleanliness for New Construction Guidelines for Intermediate Level Duct Cleanliness unless more stringent requirements are indicated herein.

B. Storage: Porous materials, such as lined and flexible duct, shall be stored where they will not be exposed to rain or other moisture sources.

C. Temporary closure: Provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris at the following conditions:

1. Exposed ends of unlined installed ducts at the end of each day
2. Exposed ends of lined ducts or plenums whether in storage or installed

D. Duct cleaning

1. Using the connected fan(s) force air at high velocity through duct to remove accumulated dust
2. Protect equipment and spaces, which may be harmed by excessive dirt with filters, or bypass during cleaning
3. In areas, which must be kept dust free, seal all outlets duct tight. When closures are removed avoid spilling dust in room

3.8 INSPECTION

A. Verify that adequate clearance between ducts and adjacent walls or equipment is available to permit proper sealing, maintenance and repairs.

3.9 PRE-OPERATING CHECKS

A. Before operating the duct systems: Set all manual dampers in full open position

B. Complete the attached Pre-Functional Test Data Sheet, Appendix 15810 A, for each duct system.

3.10 TESTING AND ADJUSTING

A. Before starting the duct systems

1. Clean the duct system. See Paragraph 3.8D
2. See Section 230800 – Commissioning of HVAC

B. After starting the duct systems: Check for noise and leakage. See Paragraphs 3.6 and 3.7. Repair as required at no additional cost to the Owner.

C. See Section 230593 – Testing, Adjusting, and Balancing: Coordination with Balance Agency:

1. Provide services of a sheet metal installer familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers
2. Install missing dampers

D. See Section 230800 – Commissioning of HVAC

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following

1. Access Doors
2. Balancing Dampers
3. Backdraft Dampers
4. Fire dampers
5. Fire and Smoke Dampers
6. Drain Pans
7. Belt Guards
8. All duct accessories except, where integral with manufactured piece of equipment.

B. Related Sections

1. Section 23 00 50 – Basic Mechanical Materials and Methods
2. Section 23 08 00 – Commissioning of HVAC
3. Section 26 – Wiring Devices

1.2 QUALITY ASSURANCE

A. Fire, smoke, and fire/smoke dampers shall be UL listed and constructed in accordance with UL Standard 555 Fire Dampers and UL Standard 555S.

B. Demonstrate operation of smoke dampers to authorities having jurisdiction and Owner's representative as part of life safety testing.

C. Access doors shall be UL labeled.

D. Damper pressure drop and leakage ratings shall be based on tests and procedures performed in accordance with AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Access Doors, Ducts

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation

3. Ruskin Mfg. Company
4. PCI Industries – Pottorff
5. Ductmate
6. Or equal

C. Access Doors, Plenum

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Elgen Manufacturing Company
4. Or equal

D. Multi-blade Volume Dampers

1. Ruskin Manufacturing Company
2. Air Balance Inc.
3. American Warming and Ventilating Inc.
4. Johnson Controls
5. PCI Industries - Pottorff
6. Or equal

E. Backdraft Dampers

1. Greenheck Fan Corp
2. Ruskin Manufacturing Company
3. Air Balance, Inc.
4. American Warming and Ventilating Inc.
5. Or equal

F. Damper Hardware

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Young Regulator Company
4. Or equal

G. Fire Dampers and Combination Smoke and Fire Dampers

1. Ruskin Manufacturing Company
2. Air Balance Inc.
3. PCI Industries - Pottorff
4. Or equal

H. Acoustical Plenums

1. Aerosonics, Inc.
2. Industrial Acoustics Inc.
3. Rink
4. Environmental Elements Corporation, Koppers Company
5. United McGill Corporation
6. Or equal.

2.2 DUCT ACCESS DOORS

A. In accordance with SMACNA Duct Construction Manuals, except as indicated in the Drawings

B. In ductwork

1. Construction
   a. Galvanized steel
   b. Rating same as duct pressure class
   c. Where duct is insulated
      1) Fiberglass insulation, thickness to match duct insulation installed R-value, see 23 0700 - HVAC Insulation
      2) Double wall
   d. Removable type with safety chain linking door permanently to frame
   e. Positive seal polyethylene gasket
   f. Paired progressive cam-locks, quantity as required for tight, low leakage fit
   g. No tools required for opening and closing
2. Size
   a. 20 inches x 14 inches unless otherwise indicated in the Drawings
   b. Ducts less than 16 inches: one dimension 20 inches; other dimension 2 inch less than duct width
   c. Larger sizes where required for access
3. Provide in following locations
   a. Coils in ducts
      1) Entering and leaving side for cooling coils
      2) Entering side for heating coils
   b. Automatic dampers: linkage side
   c. Smoke dampers
   d. Fire dampers
   e. Smoke detection heads
   f. At the top of each lined duct riser accessible from the fan room floor (for inspection of duct liner)
   g. Fan bearings enclosed in ducts
   h. Sprinkler heads in ducts
   i. Motors, actuators or other accessories that require access or service inside ducts
   j. Outdoor air plenums as required to clean plenum from dirt and debris.
   k. Where otherwise indicated on the Drawings

2.3 DAMPERS

A. Volume Dampers

1. Conform to requirements of SMACNA HVAC Duct Construction Standards.
2. General
   a. Blades of same material as duct where damper is located
   b. Damper Hardware
      1) Ventlok 400 and 4000 series or equal; for low pressure systems 2 inch SMACNA pressure class and less

2) Ventlok HiVel hardware or equal; for greater than 2 inch SMACNA pressure class
c. Actuating quadrants typical for single and multi-blade dampers; provide closed bearing on opposite end from quadrant to prevent air leakage: Ventlok No. 609 or equal
d. Bearing at one end of damper rod: Ventlok No. 609 or equal
e. Sealed bushings installed at both ends to avoid duct leakage
f. Accessible quadrant at other end of damper rod
1) With lever and lock screw: Ventlok No. 635 or equal
2) Insulated ducts
a) Quadrants mounted on collar to clear insulation
b) Ventlok Nos. 637, 638, or 639 or equal
c) Selection based on insulation thickness
g. For dampers above non-removable ceilings and without ceiling access panels provide Ventlok No. 677 or equal concealed damper regulator
1) With paintable cover plate
2) Required interconnecting hardware
3. Single blade dampers
a. Galvanized steel ductwork: galvanized steel, except as indicated in the Drawings
b. Blade: Two gages heavier than duct gage, or 18 gage, whichever is lighter
4. Multi-blade Dampers
a. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity)
1) Opposed blade damper
2) Ruskin Model CD35 or equal
b. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):
1) Rectangular
a) Opposed blade damper
b) Ruskin Model CD60 or equal
2) Round and Oval
a) Oval: Ruskin Model CDR25 and DO25 or equal
b) Round: Up to 20 inch diameter: Ruskin Model MDRS25 or equal
c) Round: Larger than 20 inch diameter: Ruskin Model CDRS25 or equal

B. Backdraft Dampers

1. Required locations
a. Where indicated on the Drawings
b. In suction or discharge of all exhaust fans as listed in equipment schedule
1) Integral, heavy-duty factory-installed type acceptable unless otherwise scheduled
2. General Applications
a. Construction
1) Extruded aluminum construction
2) Vinyl blade edge seals
3) Blade ends overlapping frame
b. Ruskin Series BD2 or equal
3. Discharge of air handlers (and other high velocity or pressure sensitive locations)

a. Frame
    1) Minimum 12 gauge galvanized steel channel
    2) Bolt Holes: Both flanges
b. Blades
    1) Airfoil-shaped with integral structural reinforcing tube running full length of each blade
    2) Material: 7 inches x minimum 0.080 inch Alloy 6063-T5 extruded aluminum
c. Axles: Minimum 3/4 inch (19 mm) diameter plated steel
d. Bearings: Ball bearings pressed into frame
e. Linkage
    1) 3/16 inch thick x 3/4 inch plated steel tie bar with minimum 16 gauge plated steel linkage arms; stainless steel pivot pins
    2) Located out of airstream (side or external linkage)
f. Counterbalance: Located out of airstream
g. Seals
    1) Blade
        a) Mechanically attach blade seals to blade
        b) Silicone rubber, rated for 300 degrees Fahrenheit
    2) Jamb: Vinyl
h. Greenheck model HB-240 or equal

2.4 FIRE DAMPERS

A. Ratings (test conditions and label) per UL Standard 555
    1. 250 degrees Fahrenheit minimum
    2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings
    3. Dynamic (closes against air flow)

B. Factory sleeve

C. Damper

    1. Curtain Type, dynamic, equipped with fusible link, spring loaded type
    2. Style
        a. As indicated on the Drawings
        b. Ducted, rectangular duct: Style B (out of airstream)
        c. Ducted, round duct: Style A (in airstream) with damper sleeve 2” in each dimension larger than duct; plus cap and collar.
        d. Unducted: Style A (in airstream)

D. Fusible link

    1. UL listed.
    2. Fusible links on fire dampers shall be constructed to UL Standard 33 – Fusible Links for Fire Protection Service
    3. Temperature rating: Per code

E. Type: as indicated on the Drawings

F. Type:

1. Rectangular type up to 1000 feet per minute: Ruskin DIBD20 Style A or equal
2. Rectangular type 1000 feet per minute and higher: Ruskin DIBD20 Style B or equal

2.5 COMBINATION SMOKE AND FIRE DAMPERS

A. Fire ratings (test conditions and label) per UL Standard 555

1. 250 degrees Fahrenheit minimum
2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings

B. Factory sleeve

C. Damper

1. Parallel blade
2. Leakage class as scheduled, minimum Class 2, rated per UL 555S
3. 120 volt actuator
4. Locate damper in sleeve starting at approximately 3” from end of the sleeve opposite the damper actuator end. (Damper shall be installed with this end protruding 3 inches out from inside surface of wall.)

D. Controls

1. Heat-actuated electric release
2. Controlled closure to prevent duct and HVAC component damage
3. Time to drive from full closed to open and or spring from full open to closed shall not exceed the following:
   a. Dampers used as part of UBC 905 Smoke Control System (those listed as having end switches in FSD schedule): 15 seconds
   b. All others: 75 seconds.
4. Damper to automatically reopen after a test, smoke detection or power failure condition. In the event of heat activated closure, the damper must be manually reset at the damper.
   a. Release temperature: 165 degrees Fahrenheit.
5. Ruskin EFL or equal

E. Status end switches: None required.

F. Type

1. Ruskin Type FSD36 or equal for 1800 feet per minute and below
2. Ruskin Type FSD60 or equal for 1800 feet per minute and above

G. Smoke Detector

1. Detects presence of smoke in the airstream of ductwork in HVAC systems without a minimum operating velocity
2. UL Listed
3. CSFM Listing
4. Ruskin DSDN or equal

2.6 DRAIN PANS

A. Field Installed Drain Pans

1. Required at field installed
   a. Cooling coils
   b. Humidifiers
2. Pan material
   a. 20 gauge stainless steel
   b. No. 18 B SG aluminum
   c. 20 gauge galvanized steel with epoxy coating
3. Supports: galvanized steel
4. Extend under coil casing
   a. Upstream: minimum 3 inches
   b. Downstream: minimum 18 inches or half the coil finned-height, whichever is larger
5. Provide additional intermediate pans for coils mounted more than one section high
   a. Minimum 3 inches upstream
   b. Minimum 8 inches downstream of eliminators
6. Extend on sides
   a. To wall of casing
   b. To receive condensate from piping and controls
7. Drain connection:
   a. Size per Uniform Mechanical Code based on coil capacity
   b. Mounted in bottom of pan at lowest point or out side with a flush mount that allows complete draining

B. Auxiliary drain pans
1. For units with cooling, above furred ceilings where required by California Mechanical Code paragraph 1205 – Condensate Control
2. Construction: galvanized steel
3. Size to capture any overflow from unit condensate drain pan
4. With separate drain from main drain pan

2.7 BELT GUARDS

A. Fabricated per SMACNA Duct Construction Standards

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. Install duct accessories in accordance with manufacturer’s written installation instructions

C. See Section 23 3112 – Ducts

D. Volume dampers

1. Provide at locations indicated on the Drawings
    a. Volume dampers shall be installed as far away from air outlets as functionally reasonable to avoid noise in the occupied space.
    b. Provide also in wyes and spin-ins to outlets whether indicated on the Drawings or not, except
        1) Where dampers are not indicated on the Drawings above inaccessible ceilings
        2) To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be provided)
2. Additional locations where dampers appear to be required for balancing, place request for information with Engineer prior to construction.
3. For ductwork exposed to occupant view, volume damper handles shall be on top of duct or otherwise concealed from occupant view.

E. Fire and smoke dampers

1. Provide in ducts and openings as indicated in the Drawings
2. Provide access door in duct adjacent to each in location where damper may be inspected and internal fusible link or fire-stat may be replaced
3. Install duct smoke detector provided by Division 16 if required; see Division 26 drawings
4. Smoke and fire dampers installed in tunnel corridors shall have weight of damper supported from structure above.

F. Control dampers

1. Field mounted control dampers installed with concealed linkage shaft accessible on side of damper with space for direct-coupled actuator
2. Actuator installation: See Section 23 -Control Systems

G. Install belt guards at all exposed belts

H. Drain pans

1. Condensate drain pans
    a. Slope to drain connection to allow complete draining of pan
    b. Piping from intermediate drain pan to lowest pan
        1) See Section 22 1316 – Plumbing
        2) Pipe to within 1 inch of and discharge into lowest drain pan
    c. Piping from lowest pan drain connection to sewer
        1) See Section 22 1316 – Plumbing
        2) Trap height and offset must allow water seal to remain and to allow complete drainage of pan both when fan is operating or not
    d. Field test
        1) Test all drain pans after installation to ensure proper slope and drainage and to prevent conditions of water stagnation that result in microbial growth.
        2) Drainage shall be considered acceptable if after covering the entire pan with 1/2 inch water, the pan drains within 3 minutes to leave puddles no more than 2 inch in diameter and no more than 1/8 inch deep.

3) Test with the fan system in operation for pans on the suction side of the fan, and with the fan off for pans on the discharge side of the fan.
4) Document tests: See Section 230050 – Basic Mechanical Materials and Methods

2. Auxiliary drain pans
   a. Piping: See Section 221316 – Plumbing
   b. Discharge where readily observed

3.2 MOUNTING AND ALIGNMENT

A. Install all accessories to prevent air leakage.

B. Install closed bearing end on all damper blades that penetrate duct to prevent air leakage.

C. Support extra weight of duct accessories. See Section 230548 – Vibration and Seismic Control

3.3 INSPECTION

A. Verify that adequate clearance between duct accessories and adjacent walls or equipment is available to permit maintenance and repairs.

3.4 PRE-OPERATING CHECKS

A. Before operating duct accessories: Set all components in normal operating condition

3.5 TESTING AND ADJUSTING

A. Before operating duct accessories see Section 230800 – Commissioning of HVAC

B. After starting duct accessories

1. Check for noise and leakage; repair as required at no additional cost to the Owner.
2. Operation test: Test each piece of equipment to show that it will operate in accordance with requirements.

C. See Section 230593 – Testing, Adjusting, and Balancing

D. See Section 230800 – Commissioning of HVAC

END OF SECTION

SECTION 233415
FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Centrifugal fans
2. Centrifugal inline fans
3. Ceiling exhaust fans
4. Wall mounted fans
5. All fans except where integral with manufactured piece of equipment

B. Related Sections

1. Section 23 08 00 – Commissioning of HVAC
2. Section 23 00 50 – Basic Mechanical Materials and Methods

1.2 REFERENCE STANDARDS

A. ANSI/AFBMA Standard 9 – Load Rating and Fatigue Life for Ball Bearings

B. AMCA 99 – Standards Handbook

C. AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

D. AMCA 300 – Reverberant Room Method for Sound Testing of Fans

E. AMCA 301 – Methods for Calculating Fan Sound

F. ANSI/AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings

1.3 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory

B. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal

C. Sound Ratings: AMCA 301; tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal

D. Fabrication: Conform the AMCA 99

E. Conform to AMCA Bulletins regarding construction and testing

1. Fans shall bear AMCA certified rating seal

F. Scheduled equipment performance is minimum capacity required.

G. Scheduled electrical capacity shall be considered as maximum available.

1.4 SUBMITTALS

A. See Section 23 00 50 – Basic Mechanical Materials and Methods

B. Include

1. Complete graph of fan curves, not just curve for design conditions
2. Sound power levels
   a. Fans 1 horsepower and larger: dB by octave bands
   b. Fans less than 1 horsepower: sones

PART 2 –PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Greenheck Fan Corporation

C. Air King

D. Fantech

E. Penn Ventilator Company, Inc.

F. Loren Cook Company

G. Acme Engineering & Manufacturing Company

H. Or equal

2.2 GENERAL

A. AMCA certification in accordance with ARI Standard 210 and 211, and AMCA Standard 2408 for centrifugal fans

B. Fans used shall not increase motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria.

C. Performance

1. See fan schedule on the Drawings.
2. Capacities: minimum as scheduled on the Drawings.

3. Brake horsepower rating: Maximum 10 percent above that scheduled on the Drawings.
4. Fans and drives shall be capable of accommodating static pressure variations of plus or minus 10 percent.
5. Motor horsepower: No larger than that scheduled on the Drawings, or compensate Division 23 contractor for any associated cost to increasing motor size.

D. Wheels

1. Class as indicated on the Drawings
2. Formed steel or extruded aluminum
3. Statically and dynamically balanced in its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.001-inch at 1200 RPM
4. Exposed fan wheels protected by finger proof screen

E. Motors: See Section 23 0513 – Common Motor Requirements for HVAC equipment.

F. Housing

1. Heavy gauge steel, spot welded for AMCA 99 designated Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
2. Factory finish before assembly with enamel or prime coat
3. Provide bolted construction
4. Weatherproof motor and drive covers at utility sets
5. Provide inspection access panels at the wheels of all blowers
6. Externally paint fans exposed to weather to provide corrosion resistance to the environment
7. Provide 3/4-inch threaded scroll drain where indicated on the Drawings and where drainage is required

G. Direct Drive

1. Less than 1 horsepower: Internal thermally protected motor

H. Belt Drive

1. Matched, multiple V-belt
2. Capacity: minimum 1.5 times motor horsepower
3. Pulleys
    a. Cast iron
    b. Variable pitch diameter
        1) Except motors with variable speed drives
        2) Fans up to 7-1/2 hp motor
        3) Fans from 10 hp to 25 hp, under 1000 rpm
    c. Fixed pitch diameter
        1) All motors with variable speed drives
        2) Fans 10 hp and over 1000 rpm
    d. Select at mid-point of range

e. For fans that operate as part of the life safety system, provide a minimum of two belts
4. Companion sheaves to maintain belts parallel
5. Drive guards
   a. Comply with requirements of State COSHA
   b. Provide holes in belt guards for tachometer readings
   c. Indoor Belt Drives: 16 gauge expanded metal or wire screen enclosure with 70 percent free area and steel frame
   d. Outdoor Belt Drives: 16 gauge solid galvanized sheet metal with stamped louvers near top and bottom for ventilation

I. Bearings

1. Ball, roller or taper
   a. Pressure type lubricating fittings with pressure relief fittings
      1) Extended to accessible locations
      2) Lubricating fittings: Equal to Alemite
      3) Pressure relief fittings: Equal to Keystone.
2. Life rating: minimum 200,000 hours per AFBMA Standard 9 L-50 rating, at maximum catalog rating

J. Painting

1. Prime coat fan wheels and housing factory inside and outside: Prime coating on aluminum parts is not required
2. Provide two additional coats of paint on fans handling air downstream of humidifiers
3. Finish painting not required for fans with corrosion resistant coatings

K. Discharge: As indicated on the Drawings

L. Removable flanged screens at inlets or outlets where no connecting ductwork is indicated: Exclude inlets to fans in field erected casings

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades

B. Install fans in accordance with manufacturer's written installation instructions.

C. See Section 233117 – Ducts for duct connections

D. See Section 230800 – Commissioning of HVAC

E. Flexible duct connection at inlet and outlet: See Section 233117 – Ducts

F. Backdraft Dampers

1. Comply with Title 24 Energy Standards and CMC

2. Provide backdraft or shutoff dampers for suction or discharge of every exhaust fan as scheduled on the Drawings
3. See schedules on the Drawings and Section 233300 – Duct Accessories for where fan manufacturer may provide dampers and when specialty damper manufacturer must provide them.

G. Propeller Fans

1. Secure housing or sleeve to wall
2. Provide additional support from overhead construction or floor by steel rods or angles if fan extends more than approximately 24 inches from wall.

H. Roof Mounted Fans

1. Install on factory fabricated curbs
   a. Exception: Install Utility fans as indicated on the Drawings
2. See Division 7 Thermal and Moisture Protection for waterproofing and roofing.
3. Roof curbs
   a. Secured to structure with hold down methods as detailed
   b. Made fully weatherproof

I. Pipe scroll drains to code compliant waste receptacle

3.2 MOUNTING AND ALIGNMENT

A. See Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

3.3 INSPECTION

A. Verify that adequate clearance between fans and adjacent walls or equipment is available to permit maintenance and repairs.

3.4 PRE-OPERATING CHECKS

A. Before operating fans

1. See Section 230800 – Commissioning of HVAC
2. Complete the attached Pre-Functional Test Data Sheet, Appendix 15830 A, for each fan

B. Do not operate fans for any purpose, temporary or permanent, until

1. Ductwork is clean
2. Filters in place
3. Bearings lubricated

3.5 TESTING AND ADJUSTING

A. Before starting fans

1. See Paragraph 3.4B

2. See Section 230800 – Commissioning of HVAC
3. Install belt and motor guards.

B. Start and test fans in accordance with manufacturers written installation instructions.

C. Start up and adjust fans to insure proper operation.

D. The submitted sound power level shall be verified through actual measurements and calculations in accordance with AMCA standards 300 and 301.

1. In the event the sound power level data measured or being submitted exceeds the designed level, provide additional sound traps or other sound attenuating devices to supplement the design in order to comply with sound power level specifications. Perform this work, including the additional noise control and any increase in motors Hp and increase in electrical service at no additional cost to the Owner. Submit calculations or measurement results to the Owner's Representative, which substantiate that sound power level produced by the submitted equipment and any required sound attenuating devices do not exceed the specified sound power levels.

E. After starting fans: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

F. Balancing: See Section 230593 – Testing, Adjusting and Balancing

G. Commissioning: See Section 230800 – Commissioning of HVAC

3.6 TRAINING

A. See Section 230800 – Commissioning of HVAC

END OF SECTION

SECTION 233713
DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment.

B. Related Sections

C. Section 23 0800 – Commissioning of HVAC

1.2 QUALITY ASSURANCE

A. Comply with ARI Standard 650 – Air Outlets and Inlets

B. Comply with ASHRAE Standard 70 – Methods of Testing for Rating the Airflow Performance of Outlets and Inlets

C. Comply with AMCA Standard 500 – Laboratory Methods of Testing dampers for Rating.

D. Comply with NFPA Standard 90A – Installation of Air Conditioning and Ventilating Systems

E. Comply with BSR/NFPA 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems

F. Provide outlets and inlets that have, as minimum, throw and noise criteria ratings for each size device as listed in manufacturer's current data, rated as required by the above standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

1. Titus
2. Krueger
3. MetalAire

4. Tuttle & Bailey
5. Price
6. Or equal

2.2 GENERAL

A. Manufacturer shall examine and approve of application of each outlet.

B. Noise level at design capacities: no larger than diffuser selection indicated on the drawings.

C. Volume dampers

1. Do not provide dampers built into grille or directly attached to the grille unless specifically called out on drawings or in this Section.
2. Volume damper key-operated adjustable from face of diffuser on register except as noted.
3. Opposed blade.

D. Diffuser frame

1. Frame type shall be coordinated with ceiling type. Refer to architectural reflected ceiling Drawings.
2. Plaster or drywall ceilings: lay-in diffuser with drywall frame (to allow for ceiling access through grille). Drywall frame to match diffuser color.
3. No visible screw allowed on diffusers or frames, unless otherwise indicated on the Drawings.

E. Outlets may be steel or aluminum unless otherwise indicated on the Drawings.

F. Color

1. Face and frame: Factory-baked #26 white enamel unless otherwise indicated on the Drawings.
2. Internal parts of grille visible from occupied space, including all parts behind perforated face diffusers and visible parts of plenums: flat black

2.3 STYLES

A. General

1. See diffuser schedule on the Drawings for outlet style and size.
2. Throw pattern per the Drawings.
3. Specific frame, border, and other product references refer to Titus Products

B. Star-pattern perforated diffuser equal to Titus PSS

1. Deflectors adjusted for corner blow pattern unless otherwise indicated.

C. Plenum Slot

1. Integral insulated plenum, minimum 1/2-inch-thick equal to Titus Type AL duct liner as specified under Section 230700 – HVAC Insulation
2. Middle tees included, match ceiling

D. Slot

1. Integral insulated plenum, minimum 1/2-inch-thick equal to Titus Type AL duct liner as specified under Section 230700 – HVAC Insulation
2. Border equal to Titus 2A
3. Mitered corners
4. Equal to Titus X-X end border and end cap

E. Flow Bar

1. Integral insulated plenum, minimum 1/2-inch-thick equal to Titus Type AL duct liner as specified under Section 230700 – HVAC Insulation
2. Equal to Titus border 22
3. Mitered corners
4. Returns to have light shield.

F. Sidewall

1. Double deflection: vertical blades on room side
2. Drywall frame with recessed screw holes, face mounting allowed.
3. Register (WSR, WER, etc.) to have opposed blade damper unless otherwise indicated on the Drawings.

G. Bar

1. Sidewall

a. Equal to Titus border Type 13, 1 inch
b. Equal to Titus Type C concealed fastening

2. Floor

a. Heavy duty core with reinforcing
b. Lay-in removable core
c. Border/Frame equal to Titus Type 5

2.4 SCREENED OPENINGS

A. Mesh

1. 3/4 in. square pattern
2. No. 16 galvanized wire
3. Interwoven
4. Welded or secured to frame.

B. Frames: Optional

1. 1 inch by 1 inch by 1/8-inch galvanized steel angles
2. Continuous around perimeter of screen.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with work of other trades.

B. Install air outlets and inlets in accordance with manufacturer's written installation instructions and Section 233112 – Ducts.

C. Return and exhaust registers: Install with blades oriented to prevent sight through outlets.

D. Grille backs or plenums visible through grilles painted flat black.

E. Transfer grilles

1. See indications on the Drawings.
2. Wall installations, unless otherwise indicated, provide two grilles.

    a. One on each side of wall, except where open to return air plenum.
    b. Connecting sheet metal collar with 18-inch elevation offset for sound and light attenuation.

F. Provide duct screens at termination ducts as indicated on the Drawings.

3.2 MOUNTING AND ALIGNMENT

A. See Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

B. All air outlets and inlets shall be secured to the building.

1. Ceiling grilles shall be secured to prevent falling from ceiling during construction or service with minimum of two 16-gage ceiling wires, two 22-gage by 1-inch galvanized sheet metal strap or two #10 sheet metal screws.
2. Comply with CBC Section 25.214

C. Mount directional grilles as indicated on the Drawings.

D. Adjust grille throw patterns.

1. As indicated on the Drawings
2. For double-deflection grilles, adjust rear blades horizontal and front blades in 45-degree pattern at each end gradually rotating to be almost straight at blades in center of grille.
3. Prior to test and balance

3.3 INSPECTION

A. Verify mounting, direction and adjustments are installed as indicated on the Drawings.

3.4 TESTING AND ADJUSTING

A. See Section 230800 – Commissioning of HVAC

B. See Section 230593 – Testing, Adjusting and Balancing for HVAC

C. See Section 230800 – Commissioning of HVAC.

END OF SECTION

SECTION 238126
SPLIT SYSTEM AIR-CONDITIONERS

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 split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control reports.

E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.2-2016, Section 4 - "Dwelling Unit Ventilation," Section 5 - "Local Exhaust," Section 6 - " Other Requirements," and Section 7 - "Air Moving Equipment."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:
   a. For Compressor: 5 year(s) from date of Substantial Completion.
   b. For Parts: 5 year(s) from date of Substantial Completion.
   c. For Labor: 5 year(s) from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: one set for each air-handling unit.
2. Gaskets: one set for each access door.
3. Fan Belts: one set) for each air-handling unit fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Amana split-system heat pumps or comparable product by one of the following:

1. Goodman.
2. Daikin.
3. Carrier.
4. Trane Co.
5. AirMark.
6. First Operations LP.
7. HITACHI
8. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.

2.2 INDOOR UNITS

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch leak tested to 300 psig underwater; with a two-position control valve.
5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for over current protection.
6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
7. Fan Motors:
   a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
   c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
8. Air stream Surfaces: Surfaces in contact with the air stream shall comply with requirements in ASHRAE 62.1-2004.
9. Filters: Permanent, cleanable.
10. Condensate Drain Pans:
    a. Fabricated with [one] [two] percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil

headers, and return bends) and humidifiers, and to direct water toward drain connection.
1) Length: Extend drain pan downstream from leaving face
2) Depth: A minimum of 2 inches deep.

b. Single-wall, galvanized-steel sheet.
c. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
1) Minimum Connection Size: 1inch.

e. Pan-Top Surface Coating: Asphaltic waterproofing compound.
f. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.3 OUTDOOR UNITS

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   a. Compressor Type: Scroll.
   b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
   c. Refrigerant Charge: R-410A.
   d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F).
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Thermostat: Low voltage with sub base to control compressor and evaporator fan.

C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

F. Drain Hose: For condensate.

G. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.1 INSTALLATION

H. Install units level and plumb.

I. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

J. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

K. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

L. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

M. Install seismic restraints.

N. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch See Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

O. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Water Coil Connections: Comply with requirements specified in Division 23 Section "Hydronic Piping." Connect hydronic piping to supply and return coil connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
2. Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Division 23 Section "Hydronic Piping" Connect hydronic piping to supply and return connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section Ducts. Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 260000
SUMMARY OF ELECTRICAL WORK

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 shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. In general, the Electrical Work described herein consists of the installation of new electrical, lighting and signal systems equipment. All work shall be completed as directed by the Owner's authorized representative, in accordance with the Contract, Specifications and Construction Documents listed below.

1. General Conditions of Contract

2. Specifications:

Section	Title
260000	Summary of Electrical Work
260100	General Conditions for Electrical Work
260500	Common Work Results for Electrical
260526	Grounding
260800	Commissioning of Electrical Systems
262413	Switchboards
265600	Exterior Lighting

3. Electrical Construction Drawings as listed on the Drawing Index of the Construction Drawing set.

B. This Section includes all necessary and required work to complete the construction as indicated in the Drawings, called for by notes or schedules, or specified herein. This work includes the furnishing of all permits, labor, supervision, services, materials, tools, equipment, testing, transportation and miscellaneous expenses, and the performance of all operations necessary to or incidental to completion of lawful and operating electrical power, lighting and signal systems, whether or not specifically mentioned.

C. All work not shown in complete detail shall be installed per the 2022 California Electrical Code and in conformance with the best standard practice for the trade. Any deviation from the approved Drawings shall be submitted in writing to the Engineer and Owner for approval prior to the installation of the work in question.

D. This work shall include, but not necessarily be limited to, the following elements:

1. Electrical Service:

   a. New electrical service, as shown, complete with underground primary conduit, transformer pad and barriers, splice boxes, and secondary conduit per serving utility company requirements.

   b. Contractor shall coordinate with utility company to ensure compliance with applicable service standards, specifications, and utility point of connection.

2. Telecommunications Service:

   a. Provide new underground conduit and vaults, as shown, for installation of new telecommunications service.

   b. Contractor shall coordinate with utility company (Comcast) to ensure compliance with applicable service standards, specifications, and utility point of connection.

3. Electrical Distribution:

   a. Power distribution system, as shown, complete with switchboards, conduits, feeders, pull boxes, fittings and related equipment and equipment pads including connections to modular buildings.

4. Grounding

   a. Grounding system including installations of ground rods, ufer grounds, and ground rings, as shown. Connections to water and/or gas piping and building steel.

   b. Provide the following grounding electrodes at each building, bonded together to form the grounding electrode system:

      1) Metal underground water pipe in direct contact with the earth for ten feet or more and electrically continuous to the points of connection of the grounding electrode conductor and the bonding conductors.

      2) The metal frame of the building, where effectively grounded.

      3) Concrete encased electrode (Ufer ground) consisting of a minimum of 20 feet of bare copper conductor (size 4 minimum) encased by a minimum of 2 inches of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth.

      4) Ground rod of copper clad steel, minimum 3/4 inch diameter, minimum 10 feet long, driven full length into the earth. If a maximum resistance to ground of 5 ohms cannot be obtained with a single ground rod, provide additional ground rods installed not closer than 6 feet apart until a maximum resistance to ground of 5 ohms is obtained.

   c. Provide testing of grounding system as outlined in Section 260800.

5. Signal Distribution:

    a. Provide trenching, conduits and conductors for signal systems as indicated on the Drawings.

6. Lighting:

    a. Provide a complete exterior lighting system including fixtures, hangers, lamps, wall switches and lighting controls.

7. Intercommunications, Clock and Program System:

    a. Complete Intercommunications system per Specification Section 275123 including amplification and distribution equipment, speakers, horns, access panels, terminal cabinets, conduit, wiring and terminations for a complete working system.

8. Electric Vehicle Charging Stations:

    a. Provide electric vehicle charging stations as indicated on Drawings complete with footings, conduit, conductors, and communications system.

9. Each system shall be terminated, tested and calibrated by a factory-authorized installer. This same installer shall terminate and test any peripheral equipment required for the operation of the system.

10. Equipment Connections

    a. Provide equipment connections and coordination in accordance with manufacturer’s recommendations and product submittals.

E. Drawings showing equipment layout, conduit runs, conduit sizes, number of wires, wire types, wire groupings and size will not be furnished. It shall be the Contractor's responsibility to prepare such drawings in accordance with specifications, project requirements and code to facilitate the installation.

F. Furnish, install and connect an underground grounding system, specifically mentioned on drawings as part of this contract, including all necessary materials and connections as required by code and/or as shown on the construction drawing.

G. Furnish, install and connect all above grade grounding materials and make aboveground connections of underground cables to equipment and/or structural steel as shown on the construction drawings and as required by code.

H. Size, furnish, install and connect new conduit, conduit fittings, and seal fittings, expansion fittings and supports. This includes above grade as well as underground.

I. Size, furnish, and install junction, pull and terminal boxes, in accordance to code requirements and as shown on the construction drawings.

J. Size, furnish and install all supports required for conduit installation, supports required for the installation of the equipment furnished by this Contractor and equipment furnished by others but installed by this Contractor.

K. Size and field cut the openings for conduits passing through building walls and/or floors. Close and seal all openings after conduits have been installed and/or removed. Closing shall be compatible with, or of the same material as wall and/or floor.

L. Furnish and install permanent "DANGER - HIGH VOLTAGE" warning signs for the switchgear and on all doors of all electrical equipment rooms, fenced yards, etc.

M. Furnish and install markers indicating voltage levels for all electrical equipment.

N. Furnish and install new nameplates per specifications on new motor control centers, motors and on all local control stations, control panels, disconnect switches, push button stations, instrument devices, etc.

O. Furnish and install wire tags in accordance with the specifications indicating wire number as shown on electrical schematics, one line, three line diagrams and specifications.

P. Perform all testing per the Specifications and report to Owner's field representative in a timely manner so as not to impede the scheduled completion of the Contract.

Q. Prime paint all uncoated carbon steel items furnished by Contractor.

R. Energize low voltage services after testing equipment and wiring in accordance with manufacturer instructions and specifications.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION 260000

SECTION 260100
GENERAL CONDITIONS FOR ELECTRICAL WORK

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 shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. The provisions of this Section shall apply to all of the following Sections of Divisions 26-28 and Division 48 of these Specifications and shall be considered a part of these Sections.

1.3 QUALITY ASSURANCE

A. All work and materials shall fully comply with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications shall be interpreted as to permit any work not in compliance with these codes. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Applicable codes include, but are not limited to, the following:

1. California Code of Regulations (CCR)
    a. Title 8, Industrial Relations
    b. Title 17, Public Health
    c. Title 24, Building Standards
2. 2022 California Building Code.
3. 2022 California Fire Code.
4. 2022 California Electrical Code.
5. Local Codes.

B. All electrical components, devices and accessories shall be listed with Underwriters Laboratories, Inc. (or other testing agency acceptable to authorities having jurisdiction), shall meet their requirements, shall bear their label wherever standards have been established and label service is regularly furnished by that agency, and shall be marked for intended use.

1.4 PERMITS, FEES AND TAXES

A. The Contractor shall secure all necessary permits and pay all required fees and taxes. He shall notify the proper authorities and have the work inspected and tested as required by jurisdictional requirements, pay all charges in connection therewith, and shall present to the Owner properly signed certificates of inspection. Acceptance of the work will not be considered until such certificates have been delivered.

B. The Owner shall pay all utility company charges related to the new electrical services. This shall include any required street lighting charges.

1.5 TEMPORARY UTILITIES

A. The Contractor shall fulfill utility requirements for and pay all one-time and monthly charges for temporary construction utility usage.

B. There is no existing onsite power available to the Contractor for construction. The Contractor shall supply any temporary facilities required to provide construction power to the site (i.e. generator) or apply for a temporary electrical service from the serving utility.

1.6 EXISTING CONDITIONS

A. The Contractor shall carefully examine the site, compare with Drawings and Specifications, and shall have satisfied himself as to the conditions to be encountered during the performance of the work. No subsequent allowance shall be made on his behalf for any additional expense he may incur due to failure or neglect of Contractor to examine site and to include existing conditions in bid.

B. The Contractor shall examine all record drawings made available by the Owner to locate existing underground systems, utilities, conduits, and pipes prior to installing the electrical distribution system. The Contractor shall also examine the site for possible locations of sprinkler pipes. Any damage done to the existing systems during the course of the electrical work, whose locations could be reasonably determined, shall be repaired to the satisfaction of the Owner and the utility or agency involved, at the expense of the Contractor.

1.7 CONDUCT OF THE WORK

A. The Contractor shall maintain on the job a competent foreman or a superintendent at all times to superintend the Work.

1.8 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

A. The Engineer’s decision will be final on interpretation of the Drawings and Specifications. Whenever the words “AS MAY BE DIRECTED”, “SUITABLE”, or “APPROVED EQUAL”, or other words of similar intent and meaning are used, implying

that judgment is to be exercised, it is understood that it is in reference to the judgement of the Engineer.

1.9 SUBMITTALS

A. Shop Drawings and Product Data

1. In addition to the provisions of Specification Section 013300, SUBMITTAL PROCEDURES, all Shop Drawings and Product Data shall comply with the following requirements:

   a. The Contractor shall submit for review, complete sets of Shop Drawings and Product Data brochures for materials and equipment as required by each section of the Specifications.

   b. All Shop Drawings and Product Data shall be submitted at one time in a neat and orderly fashion with a Title Sheet including Project Name, Engineer and Contractor, Table of Contents, and indexed tabs or bookmarks dividing each group of materials or item of equipment. The Specification paragraph number for which they are proposed shall identify all items. The mark number as indicated on Drawings shall also identify all equipment and fixtures.

   c. Shop Drawings and Product Data submittal shall include manufacturer's name and catalog numbers, dimensions, loads, and all other characteristics and accessories as listed in the Specifications or on the Drawings. All loads, characteristics, and accessories called for in the Specifications or on the Drawings shall be highlighted, circled or underlined on the Shop Drawings and Product Data. Descriptive literature shall be current factory brochures and submittal sheets.

   d. Fax submittals are not acceptable.

   e. Material or equipment shall not be ordered or installed until the Engineer processes the written review. Any item omitted from the submittal shall be provided as specified without substitution.

   f. Prior to submission of the Shop Drawings and Project Data, Contractor shall review and certify that they meet the requirements of the Contract Documents.

   g. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawings and/or Product Data are submitted or resubmitted for review. The Contractor shall consider this time when scheduling a submittal date.

B. Submittal Review

1. 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.

2. The Contractor shall agree that Shop Drawings and Product Data submittals processed by the Engineer are not Change Orders and that the purpose of Shop Drawings and Product Data submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept. The Contractor 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.

3. It shall be clearly understood that the noting of some errors, but the overlooking of others, does not grant the Contractor permission to proceed in error or in conflict with Contract Documents. 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.

4. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

C. Substitutions

1. In addition to the provisions of Specification Section 012500, SUBSTITUTION PROCEDURES, **Substitutions** shall comply with the following requirements:

   a. Manufacturers, model numbers and other pertinent information listed in the Specifications or on the Drawings are intended to establish minimum standards of performance, function and quality. Unless otherwise noted, the Contractor may submit equivalent compatible UL-listed equipment from other manufacturers for review, as long as the minimum standards are met.

   b. Calculations and other detailed data indicating how the item was selected shall be included for items that are not specified. Data must be complete enough to permit detailed comparison of every significant feature, function, performance, and quality characteristic that is specified, scheduled or detailed. The comparison must prove that the substituted item equals or exceeds the requirements of the specified item.

   c. The Contractor shall assume full responsibility that substituted items or procedures will meet the Specification and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.

   d. At the Engineer's request, the Contractor shall furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

D. Record Drawings

1. In addition to the provisions of Specification Section 017839, PROJECT RECORD DOCUMENTS, **Record Drawings** shall comply with the following requirements:

a. At the beginning of the Project, one print of each applicable Drawing will be issued to the Contractor specifically for use in preparing Record Drawings. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the Drawings. Final locations of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, e.g. building, curbs, walks. The original Drawings will be made available to the Contractor, from which he shall have made, a set of reproducible Drawings. 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, after first securing the Inspector's verification by signature.

E. Operations and Maintenance Instructions

1. In addition to the provisions of Specification Section 017823, OPERATION AND MAINTENANCE DATA **Operations and Maintenance Instructions** shall comply with the following requirements:

a. An electronic or hard copy of Operation and Maintenance Instructions and Wiring Diagrams for all equipment 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. All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation.

b. All instructions shall be submitted at the same time with tabs or bookmarks dividing each type of equipment. 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.

c. The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems.

d. The Contractor shall prepare a letter indicating that all Operation and Maintenance Instructions (printed and verbal) 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.

1.10 COORDINATION

A. See Specification Section 013113, PROJECT MANAGEMENT AND COORDINATION, for additional information and requirements.

B. Electrical Drawings are essentially diagrammatic, unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, conduits, fixtures, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interferences with each other, or with architectural, civil, mechanical, plumbing, structural or other elements.

C. While the size and location of equipment are shown to scale wherever possible, all dimensions and conduit/conductor data shall be verified in the field.

D. Where the work requires connections to be made to equipment furnished and set in place by others, the Contractor shall obtain exact rough-in dimensions from the manufacturer of such equipment and he shall install the connections in a neat and workmanlike manner.

E. If discrepancies are discovered between Drawings and Specifications requirements, the more stringent requirement shall apply.

F. All conflicts shall be called to the attention of the Architect and the Engineer prior to the installation of any work or the ordering of any equipment.

G. No work shall be prefabricated or installed prior to this coordination. No additional compensation will be considered to the Contractor for any prefabrication or installation performed prior to this coordination.

1.11 SCHEDULING

A. All work shall be scheduled subject to the review of the Architect, Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work for which contracted, as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner.

1.12 WARRANTY

A. See Specification Section 017836, WARRANTIES, for additional information and requirements.

B. Guarantee shall be in accordance with the General Conditions. These Specifications may extend the period of the guarantee for certain items. Where such extension 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.

C. Contractor shall deliver to the Owner a written guarantee on all workmanship, materials and equipment for a period of one (1) year from the date of acceptance by the Owner. Any work found to be faulty during that period of time shall be corrected at once, upon written notification, at the expense of the Contractor. This shall include repair or replacement of the premises that may be damaged as a result of faulty work and materials furnished.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new unless otherwise noted.

B. Materials and equipment of a given type shall be by the same manufacturer.

C. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance. Upon completion of work and prior to final inspection, Contractor shall thoroughly clean all exposed fixtures, trim and equipment, and shall leave the entire installation in neat, clean, and useable condition. Materials and equipment shall be free of dents, scratches, marks, shipping tags, and all defacing features at time of project acceptance.

D. The Contractor shall order materials and equipment in a timely manner to prevent any delay in the construction schedule, and he shall bear any penalty by vendors to meet schedules.

E. Verify all dimensional information to ensure proper clearance for installation of equipment. Check all materials and equipment after arrival on the jobsite and verify compliance with the Contract Documents.

PART 3 - EXECUTION

3.1 DEMOLITION

A. The Contractor shall protect existing electrical equipment and installations that are not indicated to be removed. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Exposed electrical equipment and installations, indicated to be demolished, shall be removed in their entirety.

C. Buried raceway and wiring, indicated to be abandoned in place, shall be cut 2 inches below the surface of adjacent construction and removed in its entirety. Raceways abandoned in place shall be capped and disturbed surfaces shall be patched to match existing finish.

D. Demolished material shall be removed from Project site.

E. Components indicated for relocation shall be removed, stored, cleaned, reinstalled, reconnected, and made operational.

3.2 CUTTING AND PATCHING

A. The Contractor shall perform all cutting and drilling, or other work, required to provide openings in walls, ceilings, floors, footings, foundations or other structures necessary to accomplish work under this Specification Division. The cutting shall be performed by skilled mechanics of the trades involved.

B. Cutting or 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 Architect.

C. Wherever possible, work shall be done in a concealed and neat workmanlike manner requiring the least amount of cutting of studs, plates and woodwork. Such cutting or notching is allowed only after consultation with and by permission of the Engineer.

D. The Contractor shall repair and refinish disturbed finish materials and other surfaces to accurately match adjacent undisturbed new or existing structures and surfaces and shall install new fireproofing where existing fire-stopping has been disturbed. The repair and refinishing of materials and other surfaces shall be by skilled mechanics of the trades involved.

E. All cuts are to be clean with no chipping. Where chipping occurs as a result of work in a cut area, a new clean cut shall be made immediately prior to patching.

3.3 EXCAVATION AND BACKFILL

A. The Contractor shall provide excavation and backfilling required to complete work detailed in the Drawings and Specifications. Unless otherwise noted, minimum earth cover above top of conduit outside building walls shall be 24", not including base and paving in paved areas.

B. The location of all underground facilities shall be verified with the Owner and utility companies prior to the commencement of any excavation.

C. The Contractor shall contact Underground Service Alert (USA), at 1-800-642-2444, ten (10) days prior to doing any excavation or trenching, and shall advise USA of the work schedule and comply with their requirements.

D. The Contractor shall notify the Owner 72 hours prior to any excavation.

E. Provide all shoring required by site conditions. Where over-excavation occurs, provide compacted sand backfill. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.

F. The conduit shall be laid on firm soil cut true and even to afford bearing for the full length of the barrel of the conduit.

G. When the bottom uncovered at sub-grade is soft and, in the opinion of the Engineer, cannot support the conduit, a further depth shall be excavated and refilled to conduit foundation grade as required by the Engineer.

H. Backfill (where concrete encasement is not required):

1. Material 3” below, 3” around, and to 6” above conduit shall be sand. Place carefully around and on top of conduit, taking care not to disturb conduit. Consolidate with vibrator.

2. Material from 6” Above Conduit to Grade shall 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 review by Engineer.

I. No excavation below the level of, or adjacent to, foundations of footings shall be made except in a manner approved by the Structural Engineer.

J. Compaction

1. Prior to compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Under Structures, Building Slabs, Walkways, and Steps, compact top 6” of sub-grade and each layer of backfill or fill material at 92% maximum relative compaction. Compact upper 2’ of backfill in utility trenches or other excavations to 92% minimum relative compaction.

3. In Lawns and Unpaved Areas, compact top 6” of sub-grade material to 85% relative compaction.

4. Under Pavement, compact top 8” of sub-grade immediately beneath the base course at 95% minimum relative compaction.

3.4 CONCRETE EQUIPMENT BASES

A. The Contractor shall provide a concrete equipment base for each piece of electrical equipment required to have a base as shown in the Drawings, Notes and Details.

B. Concrete equipment bases shall be 6” high concrete, 3500PSI strength, unless otherwise noted. Base shall extend 6” beyond the largest dimensions of the equipment, unless otherwise noted. The top edge of the base shall have a 3/4” chamfer. The base shall have #4 reinforcing bars at 12” on center, each way, located at the mid-depth of the base.

C. If the base is not poured at the same time as the floor slab with base rebar tied to floor rebar, the base shall be anchored to the floor slab per the following criteria:

1. Drill 1” diameter, 4” deep hole in floor.

2. Fill hole with Simpson SET Epoxy then insert 8” long, #4 rebar into hole. Tie this rebar to that required for the equipment base.

3. Provide a minimum of 4 of these anchors per base but no more than 4 feet apart in either direction.

4. Anchor points shall be 12” from the edge of the base.

D. Concrete anchors shall be steel bolts with expansion anchors requiring a drilled hole. Powder-driven anchors are not acceptable. Minimum concrete embedment shall be 4.5 diameters but not less than manufacturer’s requirements for minimum strength. Minimum spacing shall be 10 diameters center-to-center and 5 diameters center to edge of concrete but not less than manufacturer’s requirements for minimum strength. Maximum allowable stresses for tension and shear shall be 80% of the ICC-ES test report values.

E. Where applicable, concrete structures shall be submitted to the serving utility for their approval prior to installation.

F. Concrete bases for pole mounted lighting fixtures shall be 3500PSI strength, unless otherwise noted, and shall have vertical reinforcing bars with horizontal reinforcing bar ties as detailed on the drawings. The top edge of the concrete base shall have a 1” chamfer.

3.5 SEISMIC ANCHORAGE AND BRACING

A. Equipment Anchorage

1. All electrical equipment and components shall be anchored and installed per the details on the DSA approved construction documents. Where no detail is indicated, the following components shall be anchored or braced to meet the force and displacements requirements prescribed in the 2022 CBC, Sections 1617A.1.18 through 1617A.1.26. and ASCE 7-16 Chapter 13, 26, and 30:

   a. All permanent equipment and components

   b. Temporary or movable equipment that is permanently attached (e.g. hard wired) to building utility electrical service.

   c. Movable equipment which is stationed in one place for more than 8 hours and heavier than 400 pounds are required to be anchored with temporary attachments.

2. The attachment of the following electrical components shall be positively attached to the structure, but need not be detailed on the plans. These components shall have flexible connections provided between the components and associated conduit.

   a. Components weighing less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the components.

   b. Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

1) For those elements that do not require details on the approved drawings, the installation shall be subject to the approval of the Structural Engineer of Record and the DSA Structural Engineer. The project inspector will verify that all components and equipment have been anchored in accordance with above requirements.

B. Electrical Distribution System Bracing

1. Electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7-16 Section 13.3 as defined in ASCE 7-16 Section 13.6.7, 13.6.6, 13.6.5, and 2022 CBC, Sections 1617A.1.23, 1617A.1.24, 1617A.1.25, and 1617A.1.26.

2. The bracing and attachments to the structure shall be detailed on the approved drawings.

3. Copies of the manual shall be available on the jobsite prior to the start of hanging and bracing of the electrical distribution systems.

4. The Structural Engineer of Record shall verify the adequacy of the structure to support the hanger and brace loads.

3.6 CLEANING AND PROTECTION

A. The Contractor shall, progressively and at completion of the job, thoroughly clean all of his work including outlets, fittings, and devices, and inspect exposed finishes. The Contractor shall remove all burrs, dirt, grease, paint spots, stains, labels, tags, rust, foreign material, and construction debris resulting from his work.

B. The Contractor shall protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260100

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work included in this Section: “Provide” indicates all materials, labor, equipment, services, and incidentals necessary to install the Electrical Work indicated on the contract drawings and these specifications. Work includes, but is not limited to the following:
   1. Electrical and telephone services stub-outs and coordination.
   2. Distribution feeders, branch circuit wiring, wiring devices and connections to all equipment requiring electrical service.
   3. Interior and exterior building lighting fixtures, controls and connections complete.
   4. Coordination with Vendor’s associated with the construction of the project.
   5. All necessary incidental work not specifically mentioned herein or shown on the drawings shall be provided for complete and functioning systems.

B. Work specified in Division 26, 27, 28:
   1. Section 260519: Low-Voltage Electrical Power Conductors and Cables
   2. Section 260526: Grounding and Bonding for Electrical Systems
   3. Section 260529: Hangers and Supports for Electrical Systems
   4. Section 260533: Raceway and Boxes for Electrical Systems
   5. Section 260544: Sleeves and Sleeve Seals for Electrical Raceways and Cabling
   6. Section 260548: Seismic Controls for Electrical Systems
   7. Section 260553: Identification for Electrical Systems
   8. Section 262726: Wiring Devices
   9. Section 265100: LED Interior Lighting
   10. Section 283110: Fire Alarm System

1.2 INCORPORATED DOCUMENTS

A. Requirements of the General Conditions, Supplementary Conditions, and Division 1 Sections apply to all work in this Section, unless modified herein.

B. Provide equipment and materials which conform to, and perform the installation thereof in accordance with the following codes and industry standards. The applicable version of each shall be that in effect as of the date of the Contract:
   1. California Electrical Code, latest edition (CEC).
   2. California Building Code, latest edition (CBC)
   3. Underwriters' Laboratories, Inc. (UL).
   4. NFPA 101, Life Safety Code.
   5. Titles 8, 19 and 24 of the California Code of Regulations (CCR).
   6. American National Standards Institute (ANSI).
   7. California State Fire Marshal (CSFM).
   8. National Electrical Manufacturers' Association (NEMA).
   9. Institute of Electrical and Electronics Engineers (IEEE).
      a. National Electrical Safety Code (NESC).
         i. Electrical Safety Orders.
         ii. Other applicable local codes and ordinances.
   10. All local, State and Municipal Codes and Ordinances.

C. Where the authority-having-jurisdiction makes an interpretation or decision, as is their prerogative in accordance with the Code, such direction shall be considered a part of these Contract Documents as if contained herein. With respect to completing the intent of the Contract

Documents, comply with any and all requirements of the authority-having-jurisdiction and utility company field inspectors, at no additional cost.

D. The above referenced codes and standards are considered to be absolute minimum requirements. The Drawings and Specifications shall take precedence over the above referenced codes and standards where materials or workmanship of higher quality or larger size is indicated. Nothing in these Drawings or Specifications shall be construed to allow work not conforming to the applicable codes and standards.

1.3 REVIEW OF CONTRACT DOCUMENTS

A. Examine all relevant Contract Documents including Drawings, Specifications, and Shop Drawings in order to become acquainted with the Work of other installers whose activities will adjoin or be affected by the Electrical Work.

1.4 PERMITS, LICENSES, AND FEES

A. Procure and pay for all permits, licenses and fees that are required to carry out and complete the Electrical Work.

B. Pay for building department imposed inspection fees.

C. Pay utility company charges for normal or after hours shutdowns, service calls, repairs, and cable locating that are directly related to the installation of the Electrical Work.

1.5 SITE VERIFICATION OF INFORMATION

A. Visit the project site prior to submitting a bid and verify the condition, location and dimensions of buildings, equipment, and facilities. The act of submitting a bid shall indicate the Contractor to have familiarized themselves with all discernible conditions and has no exceptions to the existing conditions. There shall be no extra payment approved for work required due to existing conditions, whether specifically mentioned or not.

B. Verify at the project site, the accuracy of information shown on the Drawings regarding existing equipment, materials, and facilities. This includes but is not limited to: size, type, rating, quality, age, and serviceability. No allowance will be made on behalf of the Contractor for extra expenses resulting from the failure to discover conditions affecting the Work.

C. Lines of other services that are damaged as a result of this work shall promptly be repaired complete to the satisfaction of the Owner at no additional expense to the contract.

1.6 WORKING SPACE

A. A. Maintain adequate work space around, and access to, electrical and mechanical equipment in strict accordance with the applicable Codes. Verify during the course of construction that sufficient space will be available for the installation equipment, fixtures, etc.

1.7 QUALITY ASSURANCE

A. Conformance:
   A. The Contractor shall notify the Owner’s Representative, prior to submission of bid, about any part of the design which fails to comply with abovementioned requirements.
   B. 2. If after contract is awarded, minor changes and additions are required by aforementioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.

B. Coordination:

A. The Contractor shall become familiar with the conditions at the job site, contract drawings and specifications and plan the installation of the electrical work to conform with the existing conditions and that shown and specified so as to provide the best possible assembly of the combined work of all trades.
B. The Contractor shall work out in advance all "tight" conditions, involving all trades and if found necessary, supplementary drawings shall be prepared by this Contractor, for the Owner's Representative approval before work proceeds in these areas. No additional costs will be considered for work which must be relocated due to conflicts with the work of other trades.

1.8 MATERIALS AND SUBSTITUTIONS

A. Materials shall be new, high quality, free from defects, of standard make, and of the brand or grade as shown on the Drawings or specified herein. Specific trade names are used in the Drawings and Specifications in order to establish the standard grade and characteristics of said items. This does not imply the right upon the part of the Contractor to use other materials or methods without the approval of the Owner's Representative.

B. Electrical materials and equipment shall bear the label of, or be listed by, the Underwriters' Laboratories (UL) wherever standards have been established and label service is regularly furnished by that agency. Comply with the installation and application requirements of UL as documented in their published directories.

C. Unless specifically noted, equipment and systems shall be the product of a manufacturer who has been in the manufacture of, and has nationally distributed catalogs covering the ratings and specifications of, said equipment or systems, for a period of not less than five (5) years.

D. Maintain uniformity throughout the Project by making use of only one make or brand of material for each material used.

E. Substitutions of materials or methods will only be allowed if such items are approved in writing by the Owner's Representative as equal in quality and utility to the specified items. Submit a list of proposed substitutions within thirty (30) days of the award of the Contract. Include on the list the original manufacturer's name and model number, the proposed manufacturer's name and model number, catalog cut sheets, ratings, sizes, performance curves, shop drawings, and other data as may be required to demonstrate equality to the specified item.

F. The approval of a substitution does not authorize any deviation from the utility, size, function, or durability of the specified item unless specifically pointed out and requested in the proposed substitution list, and said deviation is approved in writing by the Owner's Representative. Responsibility of the Contractor for dimensional considerations or space conflicts is not relieved by the approval of a substitution.

G. If requested by the Owner's Representative, submit samples of materials and equipment for approval prior to installation.

H. Any and all additional costs incurred by the substitution of electrical material or equipment, or installation thereof, whether Owner's Representative, structural, plumbing, mechanical or electrical, shall be borne by the Contractor under this Section.

I. Burden of proof of equality of any substitution for a specified product is the responsibility of this Contractor.

J. Where required by Owner's Representative to ascertain equality of substitute product, Contractor may be requested to provide the specified item and the submitted substitution for comparison, at no additional cost to the Owner.

1.9 ELECTRICAL SUBMITTALS

A. See the General Conditions for conditions of submittal approval and general requirements for submission of shop drawings.

B. Submit electrical shop drawings and manufacturer's cut sheets for equipment and materials as noted in each Division 26 specification section. Bind the submittals as complete volumes according to classification of equipment such as power, lighting, etc. When possible, make all electrical submittals at the same time.

C. Submit shop drawings and supporting data as instruments of the Contractor. Stamp each item in the submittal documents with the Contractor’s stamp, thereby stating that the equipment meets all requirements and conditions of the Drawings and Specifications. In particular, certify that the items shown on the shop drawings conform to the dimensional, environmental, and space restrictions as pertains to all work under this Contract and the work of other parties in conjunction with this Project.

D. Provide a blank space on the title page of each submittal classification for the Owner’s Representative’s or Engineers approval stamp and comment field. The minimum size of such space shall be eight inches wide by five inches high.

E. Arrange panelboard submittals to show bussing, circuit numbering, and branch circuit protective devices similar the schedules on the Drawings. Show elevations of switchboards, motor control centers, and distribution centers indicating the layout of devices, meters, handles, etc. Provide device ratings, circuit numbers, and nameplate descriptions in table form. Include terminal strip mounting arrangements on elevations for terminal cabinets.

1.10 DRAWINGS AND SPECIFICATIONS

A. The data and information contained on the Drawings is as accurate as was reasonably possible at the time they were produced, but absolute accuracy is not guaranteed. Exact locations, distances, elevations, etc., will be dictated by the actual building and the conditions at the site.

B. The layout of electrical equipment, wiring, and accessories is shown in a diagrammatic fashion (not pictorially) in order to achieve clarity and legibility. Although the size and location of electrical equipment is drawn to scale wherever possible, refer to all data in the Contract Documents and field verify this information as the project progresses. Examine Owner’s Representative, structural, mechanical, and other drawings to determine the exact location of conduits, outlets, fixtures, and equipment and to note any conditions which may affect the electrical work.

C. The Drawings and Specifications may be superseded by later detail drawings and specifications prepared by the Owner’s Representative. Conform to such detail drawings, specifications, addenda, change orders, other reasonable changes as if they are contained herein. See the General Conditions for change order cost considerations.

D. Because the Electrical Drawings may be distorted for clarity of representation, it may be necessary to field verify the exact location of electrical outlets, lights, switches, etc. in order to conform to the architectural elements. The Owner’s Representative reserves the right to make minor changes to the locations of equipment, devices, and wiring shown on the Drawings, at no additional cost, providing the changes are ordered before the rough-in of conduit, boxes, or related items is completed, and no extra material are required.

E. For dimensional and locational purposes, the Architectural Drawings take precedence over the Electrical Drawings. Determine the appropriate location of lighting fixtures, outlets, wall-mounted devices, etc. by studying the reflected ceiling plans, building sections, and interior elevations. Report conflicting conditions to the Owner’s Representative before rough-in for adjustments to the locations.

F. Conduit quantities, sizes, termination points, and wiring are depicted on the Electrical Drawings. However, not all conduit bends or routing details are necessarily shown. Route conduit so as to conform to the structural conditions, avoid obstructing other trades, maintain space restrictions and keep circulation areas and access openings clear.

G. Thoroughly examine the Contract Documents prior to submitting a bid in order to determine electrical requirements which are not necessarily indicated on the Electrical Drawings. Include sufficient allowance in the bid sum to cover the costs of these other requirements.

H. Should the Contractor perceive that the Drawings and Specifications do not sufficiently define the intent of electrical work, contact the Owner's Representative for clarification or additional information. The absence of such contact will be considered as evidence of understanding, on the part of the Contractor, of the intended Electrical Work and the required installation thereof.

1.11 WORKMANSHIP

A. Constantly supervise the work personally or through an authorized and competent representative. Keep the same foreman or supervisor on the project from commencement through completion.

B. Perform the Electrical work using the highest caliber craftsman available. Workmanship shall be first class and of the best quality available to insure a long and trouble free service life. Allow only experienced and competent workmen on the job.

1.12 COOPERATION AND COORDINATION

A. Consult with the other installers and trades in coordinating the Work so as to avoid conflicts, omissions and delays. Cooperate with other contractors, third parties, and the Owner in order to expedite the project and provide for the proper execution of the building as a whole. Work performed without regard to other trades or the overall project scheme, may necessarily be required to be moved at the Contractor's expense.

1.13 MANUFACTURER'S DIRECTIONS

A. Adhere to the manufacturer's directions regarding the proper installation and configuration of electrical equipment where those directions cover points not included in these Drawings and Specifications.

1.14 PROTECTION AND STORAGE

A. Use all means necessary to protect the materials of this Division before, during, and after installation and to protect the work and materials of all trades.

B. Deliver electrical materials to the site new, and in unbroken packages. Provide for the temporary storage of such materials, equipment, and construction tools in accordance with the General Conditions and in strict accordance with approved manufacturers' recommendations. Protect electrical equipment and materials during transit, storage and handling to prevent damage, soiling and deterioration.

C. During shipping storage and handling protect electrical materials from damage of any type including dust, water, over-spray, and temperature.

D. Avoid damage during construction to the work and materials of other trades as well as the electrical work and material. Repair or replace, at the Contractor's expense, defective or damaged items such that the entire Work is completed in a condition satisfactory to the Owner's Representative.

E. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

F. This Contractor shall personally, or through an authorized representative, check all materials upon receipt at jobsite for conformance with approved shop drawings and/or plans and specifications.

1.15 EXCAVATION, CUTTING, PATCHING, AND REPAIR

A. A. Perform excavation and backfill required for the installation of electrical sub-structures. Restore grounds, walkways, roadways, curbs, walls, and other existing underground facilities to their original condition.

B. Conform to the applicable requirements of Division 2, Earthwork for Utilities, in the selection, placement, and compaction of backfill material and finished surfaces.

C. Cut, core-drill, and demolish existing walls, floors, ceilings and other building surfaces as required for the installation of Electrical Work. Obtain the approval of the Owner's Representative prior to performing any operation which may affect any structural elements of the building.

D. Patch and repair wood, plaster, tile, or concrete surfaces which have been damaged by the installation of the Electrical Work so that the finished surface matches the surrounding conditions.

1.16 FLASHING, WATERPROOFING AND SEALING

A. In general, install in an approved watertight manner, Electrical Work which pierces exterior walls or waterproofing membranes. Flash and counter-flash roof and wall penetrations in a manner described in other applicable sections of this Specification and as approved by the Owner's Representative.

B. Fit conduits passing through finished walls with steel escutcheon plates of brass, chrome, or painted finish as directed by the Owner's Representative. Grout penetrations of floor slabs, concrete or masonry walls with an approved grout or silicone elastomeric caulk.

1.17 CLEANING, ADJUSTING, AND TOUCH-UP

A. Remove on a daily basis electrical debris, scraps, packaging material and other rubbish. Dispose of such items off-site in an approved manner and debris. Maintain the site free from physical hazards at all times. See the General Conditions for additional requirements.

B. After installation, completely clean electrical equipment, fixtures, and materials of excess paint, over-spray, plaster, cement, insulating products, and other foreign matter. Leave the Electrical Work in a clean, finished, dry, level, like new condition.

C. Touch-up paint scratches and scuffs on electrical equipment and lighting fixtures with paint recommended by the manufacturer and matching the original item finish.

D. Make setting, adjustments, and programming in accordance with the manufactures' operating and installation instructions. Settings and program variables will be issued by the Owner's Representative prior to commissioning of the electrical system.

1.18 AS-BUILT DRAWINGS

A. Throughout the project, maintain accurate and current record documents. Show on the record drawings deviations from the Electrical Drawings, locations of underground conduits and pull-boxes, and concealed equipment which is not readily apparent. Dimension the record drawings using permanent, readily identified benchmarks such as column or wall lines.

B. At the completion of the project, present one clearly legible set of the record drawings to the Owner's Representative.

1.19 SCHEDULING/SEQUENCING

A. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet the construction schedule, together with any special handling charges, shall be borne by this Contractor.

B. The Contractor shall coordinate production and delivery schedule for all Owner-supplied equipment with the equipment suppliers to ensure that all Owner-supplied equipment is delivered to site in coordination with the construction schedule and in such a manner as to cause no delays in completion of the Contract as scheduled.

1.20 INSPECTIONS AND TESTING

A. Arrange for the inspection of the Work at various stages of completion by the Authority Having Jurisdiction, utility company representatives, and the Owner's Representative. Comply with all directions and remedial measures issued thereby. Any objections to these orders on the part of the Contractor must be presented to the Owner's Representative in writing within forty eight (48) hours of the inspection report.

B. Coordinate the installation of the Work so that observation of all rough-in, concealed, or underground Work can take place by the Owner's Representative. Provide a minimum of seventy two (72) hours notice to the Owner's Representative prior to covering up the work. Uncover Work that has not been properly observed and make repairs to restore the Work and adjoining surfaces to their proper condition at no additional cost.

C. Perform tests of the electrical system during the course of the project and at project completion to ensure safe and proper function in accordance with the Contract Documents, manufacturers' recommendations, and applicable codes. Provide complete documentation of all test results to the Owner's Representative prior to project completion. Testing shall include, but not necessarily be limited to, the following:

Test for short circuits, open circuits, neutral leakage, and improper grounds on feeders and branch circuits. Perform this test with mains in disconnect from feeders, branch circuits closed, fixtures and devices permanently connected, lamps removed from sockets and wall switches closed.
Provide insulation resistance tests of all phase and neutral circuit conductors using a 500 Volt Megger for circuits of 240 Volt rating and below, and a 1000 Volt Megger for circuits of 277 volts and above. Minimum acceptable insulation resistance is one (1) megohm.
Perform a ground resistance test of each main grounding electrode system, ground rod, and supplemental grounding electrode. Utilize a calibrated, direct reading, earth ground test set and make the tests using the "Three-terminal, Fall-of-Potential" method. The maximum allowable earth ground resistance is 25 ohms.
Test for proper phase-to-phase and phase-to-neutral operating voltage on the main service and on each separately derived system. Perform this test at full load and at no load. With all circuits at full operating conditions, test the phase and neutral load currents using a clamp-on ammeter.
When series rated circuit breakers are used, provide a letter from the manufacturer of the equipment confirming that U.L. series rating exists for all protective devices. State the available fault current from the Utility Company and indicate that the overcurrent devices exceed the available fault current at the respective point of protection.
Tests as required by other sections of these Specifications.
Tests as prescribed by individual equipment manufacturers whether or not described in these Specifications.

D. At project completion, demonstrate to the Owner's Representative that the entire installation is complete, in proper operation condition and that the Contract has been properly and fully executed. Activate all circuits, lights, devices, and controls under full load and normal operating conditions. Identify faulty items and immediately replace or repair defective equipment, workmanship, and materials to like new condition and retest in the presence of the Owner's Representative.

E. At the completion of the Project, demonstrate to the Owner's Representative that the entire electrical system is free from short circuits and improper grounds, or upon request of the Owner's Representative anytime, make necessary tests under the observation of the Owner's Representative which will ensure that electrical equipment, materials and installation methods are as specified.

1.21 IDENTIFICATION

A. Each branch circuit of panelboards to have a permanently fixed number with one word directory, mounted under celluloid on inside of cabinet door, showing circuit numbers and typewritten description of equipment supplied by breakers, including location.
1. All existing panelboards touched shall be updated with new panel schedules.
2. All existing equipment on existing panel schedules shall be transferred to new panel schedules.

B. Provide label on all motors: *"Caution. Automatic equipment. May start at any time."*

C. Provide identification of all pull boxes, junction boxes, and conduit stub-ups on the project as outlined below:
1. For Power Feeders:

a. Stencil cover with identifying circuit number.

b. Lettering 1" high.

c. Color of lettering black.

d. Place lettering on cover in neat manner; run parallel to long sides of box.

2. For branch circuits, grounding, communication, signal, and control systems boxes and blank conduit stub-outs. Paint inside back of each j-box, front of each cover, and ends of each blank conduit stub-out with identifying system color as listed below:

System	Color
277/480 volt	Orange
120/208 volt	Blue
Telephone/Data	Grey
Ground system	Green
Clock	Brown
Fire Alarm	Red
Audio/Visual	Yellow
Security	White
Low voltage lighting control	Orange/White

1.22 GUARANTEE

A. In accordance with Division 1 requirements.

1.23 PERMITS AND INSPECTIONS

A. This Contractor shall obtain and pay for all required permits and arrange for all inspections required.

B. Do not allow or cause any of the work to be covered or enclosed until it has been tested and/or inspected.

1.24 WARRANTIES, CERTIFICATES, AND OPERATING MANUALS

A. Properly fill out and deliver to the Owner, all warranties, guarantees, certificates, etc. for equipment and materials that are furnished and installed under this Section of the Work. The effective date on each item shall be the date of acceptance of the work by the Owner.

B. Deliver to the Owner, a minimum of two (2) copies of the manufacturers' operating and maintenance manuals for major items of equipment.

END OF SECTION

SECTION 260501
COMMON WORK RESULTS FOR ELECTRICAL

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 shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SCOPE

A. See Section 260000

1.3 STANDARDS

A. NEMA 250 Standard for Enclosures for Electrical Equipment (1000 Volts Maximum)

PART 2 - PRODUCTS

2.1 CONCRETE PADS, PULL BOXES AND MANHOLES

A. At the Contractor's option, he shall provide cast-in-place or pre-cast structures.

B. Concrete Forms and Reinforcement Materials shall be as specified in Division 03 Section "Cast-in-Place Concrete".

C. Concrete shall be 3500-psi, 28-day compressive strength as specified in Division 03 Section "Cast-in-Place concrete".

D. Weatherproof concrete pull boxes, junction boxes and telephone boxes shall be manufactured by Christy Concrete Products or equal. All boxes shall have lids marked "Power", "Signal", etc. and be traffic-rated per CalTrans drawing ES-8 minimum where pull box occurs in vehicular traffic areas.

2.2 RACEWAYS AND FITTINGS

A. Galvanized rigid steel conduit (GRC) shall meet ANSI C80.1, and be heavy wall, hot dipped galvanized inside and out, with threaded ends, for use with threaded type fittings.

B. Galvanized intermediate metallic conduit (IMC) shall meet ANSI C80.6, be zinc-coated steel and have threaded fittings.

C. Galvanized electrical metallic tubing (EMT) shall meet ANSI C80.3, and be continuous, seamless steel tubing, galvanized or sherardized on exterior, coated on interior with smooth hard finish of lacquer, varnish or enamel, with steel set-screw, steel compression or die-cast compression type fittings. Provide concrete type fittings where required or water-tight compression fittings for wet locations.

D. Rigid non-metallic conduit (RNC) shall meet NEMA TC 2, be Schedule 40 PVC, suitable for 90°C, with solvent cemented type NEMA TC3 fittings.

E. Flexible metallic conduit (FMC) shall be single strip, continuous, flexible interlocked double-wrapped steel, hot dip galvanized inside and out forming smooth internal wiring channel, with steel, compression type fittings.

F. Liquid-tight flexible metallic conduit (LFMC) shall be same as FMC except with inert sunlight-resistant, mineral-oil-resistant watertight plastic outer jacket. Fittings shall be cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings threaded to interior of conduit. Spiral molded vinyl-sealing ring between gland nut and bushing and nylon-insulated throat.

G. All raceway fittings shall be specifically designed for the raceway type with which used.

2.3 CONDUCTORS

A. All conductors shall be delivered to the site in their original unbroken packages, plainly marked or tagged with UL labels, size, type of wire, type of insulation, name of the manufacturing company and trade name of the wire.

B. All conductors shall be minimum of 98% conductivity soft drawn copper. Conductors #8 AWG and larger shall be stranded type “THWN/THHN”, 600 Volt insulation. Conductors #10 AWG and smaller shall be solid copper “THWN/THHN”, 600 Volt insulation.

C. Insulation shall be Thermoplastic Type rated at 75 degrees C minimum.

2.4 PULL BOXES AND WIREWAYS

A. Pullboxes and Enclosures for outdoor use shall be NEMA 250, Type 3R or Type 4, unless otherwise noted.

B. Pullboxes and Enclosures for indoor use shall be NEMA 250, Type 1, unless otherwise noted.

C. Wireways shall be constructed in accordance with UL 870 for wireways, auxiliary gutters and associated fittings. Every component including lengths, connectors and fittings shall be UL Listed.

D. Wireways and auxiliary gutters shall have continuous removable cover secured with screws and keyhole slots. Hinged cover shall be provided where installed above suspended ceiling.

E. Fabricated sheet steel pull boxes shall be installed only in dry, protected locations and shall be furnished with knockouts and removable screw cover. Box shall be finished with one coat of zinc chromate and a coat of primer sealer and where exposed to public view shall be painted to match the surrounding surface.

F. Weatherproof sheet steel pull boxes shall be fabricated of code gauge galvanized sheet steel with two coats of rust resistant finish and shall be furnished with gasket and made completely weathertight.

2.5 WIRING DEVICES AND MATERIALS

A. Outlet Boxes shall meet NEMA OS1 and be galvanized code gauge steel. Boxes in masonry shall be square cornered. Boxes exposed to weather or in wet locations shall be Type FD cast metal with external threaded hubs and gasketed cover and shall meet NEMA FB1.

B. Outlet box extensions shall be U.L. listed and shall be attached to box with threaded metal screws

C. Approved manufacturers of metal boxes are Circle AW, Crouse-Hinds, Steel City or equal.

D. Receptacles:

1. Duplex Receptacles:

a. Duplex Receptacles shall be tamper-resistant, full gang size, polarized duplex, parallel blade, U-grounding slot, specification grade, rated at 20 amperes, 125 volts and designed for split feed service.

b. Receptacles shall be white in color.

c. Duplex receptacles shall be Hubbell HBL5362WTR series or equal.

2. GFCI Receptacles:

a. GFCI receptacles shall be weather-resistant, tamper-resistant, duplex, feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Units shall be designed for installation in a 2-3/4-inch deep outlet box without an adapter.

b. Duplex GFCI receptacles shall be Hubbell #GFTWRST20W series, or equivalent to match regular duplex receptacles.

3. Required California Energy Code Controlled Receptacles: Provide one controlled duplex receptacle within 6-feet of each uncontrolled receptacle in all private offices, open office areas, reception lobbies, conference rooms, kitchenettes in office spaces and copy rooms as required by 2022 California Energy Code Section 130.5(d). Controlled receptacles shall be permanently factory marked with the symbol shown in 2022 CEC Figure 406.3(E) and the word “controlled”. Adhesive labels shall not be permitted in lieu of permanent factory marking. Controlled receptacles shall be tamper-resistant Hubbell HBL5362C2WHITR series or equivalent.

4. Required Weather-Resistant Receptacles: All 15- and 20-ampere, 125- and 250-volt non-locking type receptacles located outdoors and in damp and wet locations shall be listed weather-resistant type.

5. All 15- and 20-ampere, 125- and 250-volt receptacles shall be tamper-resistant type.

6. Receptacles for Owner-furnished equipment shall match that equipment’s plug configuration.

7. Other Receptacles: Other receptacles shall match the plug configuration and ratings required for the utilization equipment that is served.

E. Device cover plates shall be provided and installed at all wiring devices, switches, outlets, and similar applications, and shall be as directed by architect. Pull boxes and junction boxes to which no fixture is to be attached shall be fitted with blank cover plates painted to match surrounding. All cover plates installed on rated walls shall be brushed stainless steel. Cover plates for receptacles in wet locations shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted and shall be identified as “extra-duty”.

2.6 TERMINAL CABINETS AND CLOSETS

A. Cabinets and fronts shall be in accordance with NEMA Standard Publication No. PB1-1971 and UL Standards No. 67. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring loaded door pulls. The flush lock shall not protrude beyond the front of the door. All locks shall be keyed like the panel board locks. Fronts shall have adjustable indicating trim clamps that shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. Fronts shall not be removable with the door in the locked position. A frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge full finished steel with rust inhibiting primer and baked enamel finish.

2.7 DISCONNECTING DEVICES

A. Disconnecting devices shall be provided as shown and/or as required by CEC.

B. Motor-rated switches shall be toggle-type, quick make-quick break, rated 2 HP, 250 VAC, with number of poles as required. They shall be equipped with overload heaters rated for overload protection of loads controlled.

C. Motor-rated switches shall be flush-mounted adjacent to load controlled. Where flush mounting is not possible, switches shall be surface mounted in NEMA enclosure suitable for environment in which installed.

D. Disconnect switches shall be 250V or 600V class, rated heavy-duty, horsepower rated, quick-make, quick-break, dead-front type and provided with proper number of poles.

E. Disconnect Switches shall be self contained in a NEMA 1 gasketed enclosure (NEMA 3R where installed outdoors) and externally operable from the front.

F. Fusible disconnect switches shall be equipped with rejection type clips suitable for UL Class R fuses up to 600A and suitable for UL Class L fuses above 600A. Fuse interrupting rating shall be 200,000 RMS symmetrical amperes.

G. Circuit breakers utilized as disconnecting devices shall comply with the requirements stated in other articles of this section and CEC.

2.8 FUSES

A. Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Bussman
2. Gould Shawmut
3. Littlefuse
4. Or approved equal.

B. Fuses 600 amperes and below shall be UL Class RK1, 200,000 RMS symmetrical amperes interrupting rating.

2.9 SUPPORTING DEVICES

A. Supporting devices shall be constructed of cold-formed steel, with a corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal items for use outdoors or in damp locations shall be hot-dipped galvanized steel.

C. Slotted-steel channel supports shall have flanged edges turned toward the web, and 9/16-inch diameter slotted holes at a maximum of 2 inches on center, in the web.

1. Channel thickness shall be selected to suit structural loading.

2. Fittings and accessories shall be products of the same manufacturer as the channel supports.

D. Raceway and cable supports shall be manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe sleeves shall be ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, with plain ends.

F. Cable supports for vertical conduit shall be a factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs shall have number and size of conductor gripping holes as required to suit individual risers. Body shall be constructed of malleable-iron casting with hot-dip galvanized finish.

G. Concrete anchors shall be steel bolts with expansion anchors requiring a drilled hole. Powder driven anchors are not acceptable.

H. Toggle bolts shall be all-steel springhead type.

2.10 ELECTRICAL IDENTIFICATION

A. Identification devices shall be a single type of product for each application category. Colors shall be as prescribed by ANSI A13.1, CEC, and these Specifications.

B. Raceway and cable labels shall comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Pre-tensioned, wraparound plastic sleeves shall be a flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.

2. Preprinted, flexible, self-adhesive, vinyl labels shall have a legend, over-laminated with a clear, weather- and chemical-resistant coating.

3. Color shall be black letters on orange background.

4. Legend shall indicate voltage.

C. Self-adhesive colored marking tape for raceways, wires and cables shall be vinyl tape, not less than 1 inch wide by 3 mils thick.

D. Underground Warning Tape shall be vinyl tape, compounded for permanent direct-burial service, not less than 6 inches wide by 4 mils thick, embedded with a continuous metallic strip or core, brightly-colored, continuously-printed with a legend that indicates the type of underground line.

E. Tape markers for wire shall be vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-coding cable ties shall be made of Type 6/6 nylon, be self-locking type and of colors to suit coding scheme.

G. Engraved plastic labels, signs and instruction plates shall be made from black (or red as noted) Bakelite laminate engraving stock with a white core, punched or drilled for mechanical fasteners. It shall have a minimum thickness of 1/16-inch for signs up to 20 sq. in. and a minimum thickness of 1/8-inch for larger sizes.

H. Interior Warning and Caution signs shall comply with 29 CFR, Chapter XVII, Part 1910.145 and shall be preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution signs shall comply with 29 CFR, Chapter XVII, Part 1910.145 and shall be weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. They shall be equipped with 1/4-inch grommets in each corner for mounting.

J. Fasteners for nameplates and signs shall be self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

K. Circuit Identification – A typewritten circuit directory shall be provided at each panelboard and switchboard in accordance with CEC Article 408.4(A). The Contractor shall develop and prepare the circuit identification description based on the as-built condition.

L. Source of Supply Identification – All switchboards, panelboards and transformers shall have a typewritten label applied indicating the device or equipment where the power supply originates per CEC Article 408.4(B).

2.11 TOUCHUP PAINT

A. Touch-up paint shall be equipment manufacturer’s paint selected to match installed equipment finish.

B. Touch-up paint on galvanized surfaces shall be zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL INSTALLATION

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the 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 throughout the construction of the project.

B. The layout and installation of electrical work shall be coordinated with the overall construction schedule to prevent delay in completion of the project.

C. Dimensions and information regarding accurate locations of equipment and structural limitations and finish shall be verified with other sections.

D. The drawings do not show all raceway, wiring, offsets, bends, special fittings, junction or pull boxes necessary to meet job conditions. Items not shown as indicated, where are clearly necessary for proper operation or installation of systems shown, shall be provided as required, at no increase in contract price.

E. Materials and Components shall be installed level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

F. Electrical equipment, outlets, junctions and pull boxes shall be installed in accessible locations, avoiding obstructions, preserving maximum headroom, and keeping openings and passageways clear.

G. Equipment shall be installed to facilitate service, maintenance, and repair or replacement of components. It shall be connected for ease of disconnecting, with minimum interference with other installations. Minor adjustments in the locations of equipment shall be made where necessary providing such adjustments do not adversely affect function of the equipment. Major adjustments for the location of equipment shall be previously approved and detailed on the Record Drawings.

H. Right of Way shall be given to raceways and piping systems installed at a required slope.

3.2 PRECAST CONCRETE PULL BOXES AND MANHOLES

A. Contractor shall provide a minimum of 3-6" of sand base material suitable to receive the pullbox or manhole. The base material shall be compacted and graded level at proper elevation to receive the pullbox or manhole in relation to the conduit grade or ground cover requirements as designated in the plans.

B. Sealants used between the joints of the pullbox or manhole are at the Contractor's discretion unless otherwise specified. If grout is used, it should consist of two parts plaster sand to one part cement with sufficient water added to make the grout flow under its own weight. The grout should be poured into a water soaked groove and filled to the top of the groove unless a double amount is to be used as a further precaution against leakage. In this case, the mastic sealant should be placed on the two shoulders of the groove. The next section of pullbox or manhole should be placed while the foaming action is in process. Contractor shall verify grades with the Engineer and shall set holes and boxes level at proper grades.

C. All conduits penetrating the pull box or manhole shall have seals to prevent water from entering the raceway.

3.3 RACEWAY APPLICATION

A. Galvanized Rigid Steel Conduit (GRC) may be used in all locations. Where installed in direct contact with earth, conduit shall be wrapped with two layers of half-lapped 10-mil PVC tape for a total thickness of 40-mil or have a factory applied 40-mil PVC coating.

B. Galvanized Rigid Steel Conduit (GRC) shall be used where exposed to physical damage, indoors where exposed to moisture, in exposed outdoor installations, in systems higher than 600 volts, and where required by code.

C. Galvanized Intermediate Metallic Conduit (IMC) may be used in indoor locations not in direct contact with earth.

D. Galvanized Electrical Metallic Tubing (EMT) may be used in dry indoor locations according to the following criteria:

1. It is not subject to physical damage.

2. It is not in direct contact with earth.

3. It is not in concrete slabs.

4. It is not in a hazardous area.

E. Rigid Non-Metallic Conduit (RNC) Schedule 40 PVC may be used underground or below concrete slabs on grade. Rigid Non-Metallic Conduit (RNC) Schedule 80 PVC may be used to pass through concrete slabs. Rigid Non-Metallic Conduit (RNC) may be used in compliance with utility company requirements for utility service conduits. Rigid Non-Metallic Conduit (RNC) shall not be installed above grade or above finished floor level.

F. Liquid-tight Flexible Metallic Conduit (LFMC) may be used in all locations to make final connections to motors, transformers, or other mechanical equipment (not to exceed 24 inches in length) or lighting fixtures (not to exceed 72 inches in length). Where specifically approved by the Engineer, LFMC may be used to

facilitate wiring in tight locations or in other conditions that make the use of other conduit impracticable.

G. Flexible Metallic Conduit (FMC) may be used in dry locations to make final connections to motors, transformers, or other mechanical equipment (not to exceed 24 inches in length) or lighting fixtures (not to exceed 72 inches in length). Where specifically approved by the Engineer, FMC may be used to facilitate wiring in tight locations or in other conditions that make the use of other conduit impracticable.

3.4 RACEWAY INSTALLATION

A. General

1. Expansion joints shall be provided at building expansion joints or as required due to length of run or difference in temperatures.

2. All fittings that are exposed or in damp areas shall have sealing glands and proper gasket.

3. In general, all conduits shall be sloping to drain. Bends that place a trap in a conduit shall be avoided. Provided drip fitting as required. Dux-Seal high ends of all underground raceways.

4. All conduit runs shall be mechanically and electrically continuous from outlet to outlet. Conduit size or type shall not be changed between outlets.

5. All empty raceways shall be equipped with pull lines, capped and labeled. Pull lines shall be 3/16” polypropylene, No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24 inches of slack with identification tag at each end of the pull wire.

6. Minimum size of any conduit for lighting, power and signal shall be ¾” conduit unless shown otherwise.

7. Use temporary raceway caps to prevent foreign matter from entering. Immediately prior to installation of conductors, conduit shall be blown and swept free of foreign materials. All conduit stubs for future, both above and below grade, shall be capped. Run conduits for spare panelboard circuits to attic or accessible spaces.

8. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

9. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

10. There shall be no more than the equivalent of four quarter bends (360-degrees total) between pull points such as pull boxes, outlet boxes or conduit bodies, in one run of conduit.

11. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

12. Conduits shall be securely fastened to building structure at intervals not greater than ten feet.

13. Conduit shall be square cut and reamed if required to full size, with thread full cut and true.

14. Conduits shall be jointed by approved couplings with ends of conduits tightly butted. Non-insulating compound shall be used in making up joints below grade or inside on grade to insure a watertight system.

15. Conduit connections to outlet boxes or cabinets shall be made with approved connectors, using locknuts and insulated throat bushings.

16. Complete raceway installation before starting conductor installation.

17. Contractor shall provide rubber grommets to fasten galvanized conduit to exterior structures made of dissimilar metals at all exterior locations to prevent galvanic corrosion.

18. Contractor shall provide rubber grommets to fasten galvanized conduit to supports which are also used by other systems utilizing piping of dissimilar metals to prevent galvanic corrosion.

B. Interior

1. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

2. All concealed conduits shall be installed in as direct a line as possible between outlets. No more than four quarter bends, or their equivalent, will be allowed between outlets. Feeder conduits shall follow arrangement shown on plans unless a change is authorized. Branch circuit conduits shall, in general, follow arrangement as shown as far as structural conditions permit. All exposed runs shall parallel buildings, walls, or partitions, and be supported on Kindorf Hangers to meet Title 24, Part 6, CAC.

C. Exterior

1. Exterior conduit including the sweep below grade and the vertical riser shall be galvanized rigid steel conduit, except where rigid non-metallic conduit is required for utility service conduits by the serving utility company.

2. No rigid non-metallic conduit (RNC) shall be installed above grade.

D. Below Grade Level Concrete Building Slab

1. All conduits below the building slab shall be Schedule 40 PVC rigid nonmetallic conduit or full weight galvanized rigid steel conduit, and shall have a 6” minimum cover below the floor slab measured from the bottom of the floor slab to the top of the conduit.

2. Rigid non-metallic conduits that are 1” trade size or smaller that are installed below the building slab shall transition from Schedule 40 PVC below the building slab to Schedule 80 PVC rigid nonmetallic conduit or galvanized rigid steel conduit, before passing into the concrete building slab and shall transition to galvanized rigid steel conduit or IMC within the concrete building slab before exiting and rising above the building slab.

3. Rigid non-metallic conduits that are 1 ¼” trade size or larger that are installed below the building slab shall have a galvanized rigid steel long radius elbow installed at the terminating end where the transition from horizontal to vertical occurs and the vertical riser shall be galvanized rigid steel conduit rising above the building slab.

4. Rigid non-metallic conduit installed underground and not below a building slab.

5. Where conduits rise through the building slab they shall be installed at sufficient depth so that the curved portion of any bends, sweeps, or 90’s are not visible above the finished slab.

6. Contractor shall be responsible for damages to membrane and shall repair it.

E. Signal Systems

1. Install telephone and signal system raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent.

2. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

F. Flexible Conduit

1. LFMC or FMC shall be used to connect motors and equipment subject to vibration, noise transmission, or movement to junction boxes, with a maximum length of 24-inches.

2. Install separate ground conductor across flexible connections.

3. Flexible conduits shall be independently suspended.

3.5 CONDUCTOR APPLICATION

A. Feeders shall be Type THHN/THWN insulated conductors in raceway.

B. Underground feeders and branch circuits shall be Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch circuits shall be Type THW or THHN/THWN insulated conductors in raceway where exposed and may be metal-clad cable where concealed in ceilings and gypsum board partitions.

D. Lighting branch circuits shall be Type THW or THHN/THWN insulated conductors in raceway where exposed and may be metal-clad cable where concealed in ceilings and gypsum board partitions.

E. Minimum conductor size shall be #12 for power and lighting, #14 for 120V control circuits and #18 for 24V control circuits.

F. Remote control, signaling and power-limited circuits shall be Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.6 CONDUCTOR INSTALLATION

A. Conductors shall be continuous from outlet to outlet, no splices shall be made except within outlet or junction boxes.

B. Wiring at outlets shall be installed with at least 12 inches of slack conductor at each outlet.

C. Outlet and component connections shall be made to wiring systems and to ground. Electrical connectors and terminals shall be tightened according to manufacturer's published torque-tightening values. Torque values specified in UL 486A shall be used where manufacturer's torque values are not indicated.

D. Wire in panels, cabinets, pull boxes, and wiring gutters shall be squared, labeled, and neatly grouped with cable ties and fanned out to the terminals.

E. All branch circuits, fixture wiring joints, splices, and taps for conductors #10 and smaller shall be made with 3M "Scotchlock" connectors, or approved equal.

F. All branch circuits, fixture wiring joints, splices, and taps for conductors #8 and larger shall be made with two-bolt type solderless connectors or T & B "color keyed" compression lugs.

G. Bolt-type solderless connectors shall be torqued with a torque wrench according to the manufacturer's recommendations, and then retightened after 24-48 hours before taping. Owners' inspector shall be informed of this procedure during the waiting period and shall witness the act of retightening.

H. Connectors and lugs for terminating stranded conductors #8 and larger shall be machine crimp compression type.

I. All splices shall be taped with Scotch #88 plastic electrical tape with “Scotch Fill” where necessary for a smooth joint. Scotch #27 or #2520 shall be used for other than normal temperatures or conditions. All connections and splices shall be electrically perfect and in strict accordance with all code requirements.

J. No splices shall be made below grade in a manhole or pullholes without Engineer’s written approval, and then shall be encapsulated with 3M potting kits per 3M Specifications. For larger gauge wire where 3M potting kits are prohibited Contractor shall use submersible UL listed Polaris connectors by NSi.

3.7 WIREWAY AND AUXILIARY GUTTER APPLICATION

A. Wireways and auxiliary gutters shall be used above and below panelboards, lighting relay cabinets, and terminal cabinets to accommodate large concentrations of wires.

3.8 PULL BOXES AND WIREWAYS:

A. Boxes shall be installed square and plumb. An engraved nameplate shall be installed on each box indicating its function. Nameplate shall be installed on the exterior of each box in unfinished areas and on the interior of each box in finished areas.

B. Wireways shall be installed with strip-type connectors with self-retained mounting screws. Hangers with two piece, hook together features shall be used to permit preassembly of wireway and hanger bottom plate before hanging on a preinstalled upper bracket.

C. Pull and junction boxes shall be installed as shown to ease the pulling of wire and to comply with CEC requirements.

3.9 WIRING DEVICES AND MATERIALS

A. Outlets shall be mounted at 18” minimum above finished floor unless otherwise noted. No less than 15” measured from the bottom of the device to the finished floor or platform.

B. The locations of outlets shown on drawings shall be located with respect to work of others and to be symmetrical with room layout.

C. Outlets in architectural patterned surfaces such as tile and finish panels shall be centered on intersections of four panels or in exact center of panels, unless otherwise shown on architectural plans or directed by Architect.

D. Outlet boxes for concealed work shall be one-piece steel knock out type with zinc coating. Boxes shall not be smaller than 4” square nominal size, unless

otherwise indicated. Extension rings, plaster rings, and covers shall be provided as necessary for flush finish.

E. The Contractor shall inform himself of wall thickness throughout the building and shall provide outlet boxes of suitable depth that can be flush mounted and yet will be deep enough to contain the particular apparatus involved. Location of exposed pull or junction boxes will be subject to the Architect's approval.

F. Outlet boxes on opposite sides of walls shall not be placed back-to-back, nor shall "through" boxes be employed (except where specifically permitted on the drawings by note).

G. Switches shall be mounted 48" to top of device box above finished floor unless otherwise noted.

H. Where more than one switch occurs at the same location, use multiple gang outlet boxes covered by a single plate; provide box partitions as required by the N.E.C.

I. Bar hangers shall be used to support outlet boxes in stud or furred partitions and ceilings. Attachment screws, devices, etc., shall be of the proper type to secure boxes to metal studs complemented by expansion shields to concrete and masonry.

J. All outlet boxes and particularly those supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures, not from acoustic ceilings. All lighting fixture outlets shall be coordinated with mechanical, architectural, or other equipment to eliminate conflicts and provide a workable, neat installation.

K. Approved knock out holes shall be provided. Outlet boxes from which light fixtures will be suspended shall be equipped with 3/8" fixture studs fastened through from back of box.

L. Surface boxes of the cast metal threaded hub type with suitable gasketed covers shall be used for exposed conduit runs less than 5' above a finished floor or where waterproof boxes are required.

M. Floor boxes shall be adjustable, brass trimmed with carpet flanges where carpet is indicated on architectural drawings.

N. Set floor boxes level and trim after installation to fit flush to finished floor surface.

O. Masonry boxes shall have conduit entrances to rear of box with depth as required to clear masonry.

P. Boxes shall be sized for number of conductors entering box.

Q. Wiring devices shall be securely fastened to the outlet box. Where the outlet box covers are back from the finished walls, the device shall be built out with washers

so that it is rigidly held in place to the box. Metal extenders shall be provided in flammable construction per CEC.

R. All device screw slots shall be left in a vertical orientation.

S. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor and to outlet box with bonding jumper.

T. Connect ground terminal of isolated-ground receptacles to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

3.10 TERMINAL CABINETS AND CLOSETS

A. Terminal cabinets shall be installed level and identified with nameplate per schedule.

B. All conductors in terminal cabinets or closets shall be squared, labeled and secured neatly with wire ties.

C. All terminal cabinets shall be installed with the top of the trim at 6’-0” above the finished floor, unless otherwise indicated on the drawings.

D. Where space permits, terminal cabinets shall be surface mounted where they are not visible to the public.

E. A typewritten directory shall be mounted behind plastic in a metal holder welded to the inside of each terminal cabinet door showing a complete description of terminations in each cabinet.

3.11 DISCONNECT DEVICES

A. Thoroughly examine site conditions for acceptance of disconnects switch installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Coordinate locations of switches and equipment in the field to provide code required clearances in front of switches and to insure that switches are in sight of the controllers as described in CEC Article 430.

C. Install disconnect switches where indicated on the Drawings.

D. Install fuses in fusible disconnect switches.

E. Include construction channel and mounting hardware as required to support disconnect switch.

F. Provide engraved, machine screw retained nameplate on each disconnect switch. Name plate shall identify equipment and panelboard + branch circuit breaker.

3.12 SUPPORTING DEVICE APPLICATION

A. Hot-dip galvanized materials or nonmetallic channel and angle system components shall be used in damp locations and outdoors.

B. Steel materials shall be used in dry locations.

C. Support clamps for PVC raceways shall be click-type clamp system.

D. Strength of supports shall be adequate to carry present and future loads, times a safety factor of at least four with a minimum of 200-lb design load.

3.13 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, according to the following criteria, unless otherwise noted:

1. Wood – wood screws or screw-type nails.

2. Masonry – toggle bolts on hollow masonry units, expansion bolts on solid masonry units.

3. New Concrete – concrete inserts with machine screws and bolts.

4. Existing Concrete – expansion bolts.

5. Steel – welded threaded studs or spring-tension clamps on steel. Field welding shall comply with AWS D1.1. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.

6. Light Steel – sheet-metal screws.

7. Fasteners shall be selected so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.14 ELECTRICAL IDENTIFICATION

A. Each conductor of every system shall be permanently tagged in each panelboard, pull box, J-box, etc., in compliance with the Occupational Safety and Health Administration (OSHA).

B. Brady labels shall be used to identify terminals and destination of feeders, branch circuits, signal and control circuits, etc., at all terminations, junction boxes and pull boxes, and shall be coordinated with the nameplates in all boxes and equipment.

C. All terminals in the switchboards, panels, relays, switches, devices, starter terminals, etc., shall have Brady labels for identification to identify both ends of all wiring.

D. The Contractor shall furnish and install 1” x 3” x 3/32” thick laminated black Bakelite nameplates with a white core (unless specifically shown as red) engraved to produce white letters on black background for all items of electrical equipment, including 2-pole and 3-pole circuit breakers, panelboards, starters, relays, time switches and disconnect switches.

E. All devices shall have their branch circuit identified on the back side of device plate with a permanent type black marker, i.e. CT A-21. Identify panelboard and circuit number from which receptacles are served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

F. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

G. Panels having single-pole circuit breakers shall be provided with typed schedules mounted in welded metal holders behind plastic.

H. Clean surfaces that are to receive self-adhesive identification products before applying.

I. Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

J. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

K. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

L. All power conductors shall be identified in accordance with the following schedule:

1. 120/208V, 3 Phase, 4 Wire System.
    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.
    d. Neutral: White.
    e. Ground: Green
2. 277/480V, 3 Phase, 4 Wire System.
    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.
    d. Neutral: White with a colored stripe or gray.
    e. Ground: Green.

M. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.15 FIRESTOPPING

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration, either before, during, or after the fire. The fire and temperature ratings of the penetration assembly shall be at least that of the floor, wall, or ceiling into which it is installed so that the original fire rating of the floor or wall is maintained as required by Article 300.21 of the California Electrical Code (CEC).

B. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, and/or Thomas and Bett Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps and other accessories as required. All manufacturers' instructions and recommendations for installation of sealing fittings and barrier sealing systems.

C. The Contractor shall repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed new structures, surfaces and shall install new fireproofing where existing firestopping has been disturbed. The repair and refinishing of materials and other surfaces shall be by skilled mechanics of the trades involved.

3.16 REFINISHING AND TOUCHUP PAINTING

A. The Contractor shall clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location. He shall follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

B. Damage to galvanized finishes shall be repaired with zinc-rich paint recommended by manufacturer.

C. Damage to PVC or paint finishes shall be repaired with matching touchup coating recommended by manufacturer.

3.17 SYSTEM TESTING AND STARTUP

A. Refer to Specification Section 260800 "Commissioning of Electrical Systems" for minimum required systems testing and startup.

3.18 TITLE 24 - PART 6 DOCUMENTATION OF INSTALLATION AND ACCEPTANCE FOR ELECTRICAL POWER DISTRIBUTION SYSTEMS

A. The Contractor shall prepare and submit the following Certificates of Installation:

1. Electrical:

a. Certificate of Installation – Electrical Power Distribution (NRCI-ELE-01-E)

END OF SECTION 260500

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.

2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with CEC.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wire and Cable (600V)
   a. American Wire Company
   b. Belden
   c. General Wire and Cable Corporation
   d. Okonite Company
   e. Rome Cable Corporation
   f. Cerrowire
   g. American Insulated Wire
   h. AFC Cable Systems
   i. Essex
   j. Simplex Wire and Cable Company

2. Solderless Lugs and Grounding Connections
   a. Burndy Engineering Company, Inc.
   b. O.Z. Gedney Company, Inc.
   c. Penn Union Electric Corporation
   d. Thomas and Betts Company, Inc.

2.2 CONDUCTORS AND CABLES

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.

2.3 CONNECTORS AND SPLICES

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. AFC Cable Systems, Inc.
   3. Hubbell Power Systems, Inc.
   4. O-Z/Gedney; EGS Electrical Group LLC.
   5. 3M; Electrical Products Division.
   6. Tyco Electronics Corp.

E. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. 600-volt class, insulation color coded, minimum No. 12 AWG for branch circuits, No. 14 AWG for control circuits.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

D. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

J. Insulation type:
   1. Standard locations: #12 to #1 AWG: THWN for wet locations and THHN for dry locations. #1/0 through #4/0 AWG: XHHW (55 Mils). 250MCM and larger: XHHW (65 Mils). All wire sizes used shall be based on a 75 degree insulation rating, unless specifically used with 90 degree rated breakers and devices.
   2. High temperature and non-standard locations: Provide wire type and insulation category suitable for area of use as defined in CEC table 310-13.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

K. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

L. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

M. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

N. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

O. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

P. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

Q. Install all wiring (low voltage and line voltage) in conduit unless noted otherwise in the drawings, but do not pull into conduit until plastering and taping have been completed and conduits and outlets have been thoroughly cleaned and swabbed as necessary to remove water and debris.

R. Approximately balance branch circuits about the neutral conductors in panels.

S. Connections to devices from "thru-feed" branch circuit conductors to be made with pigtails, with no interruption of the branch circuit conductors.

T. Neutral conductor identified by white outer braid, with different tracers of "EZ" numbering tags used where more than one neutral conductor is contained in a single raceway.

U. Neatly arrange and "marlin" wires in panels and distribution panelboards with "T and B Ty-rap" or approved equal plastic type strapping.

V. All wire and cable shall bear the Underwriters' Label, brought to the job in unbroken packages; wire color-coded as follows:

VOLTAGE	PHASING	A	B	C	N
120/208	3PH-4W	BLACK	RED	BLUE	WHITE
208	3PH-3W	BLACK	RED	BLUE	--
277/480	3PH-4W	BROWN	ORANGE	YELLOW	WHITE
480	3PH-3W	BROWN	ORANGE	YELLOW	--
120/240	3PH-4W	BLACK	RED	BLUE	WHITE
240	3PH-3W	BLAC	RED	BLUE	--

W. The equipment grounding conductor shall be insulated copper; where it is insulated, the insulation shall be colored green.

X. Label each wire of each electrical system in each pull box, junction box, outlet box, terminal cabinet, and panelboard in which it appears with "EZ" numbering tags indicating the connected circuit numbers.

Y. Properly identify the “high leg” of 4-wire delta connected systems (in each accessible location) as required by CEC 215-8 and 230-56.

3.4 INSTALLATION OF DICONNECTS, CONNECTORS, AND LUGS

A. Equipment Disconnects: All disconnects shall be located to allow proper code required clearance in each area. Locations shown on drawings are diagrammatic only. The contractor shall coordinate exact locations in the field (with other trades) prior to rough-in to insure proper clearances.

1. Motor Disconnect Switches and Safety Switches: General Electric Company Heavy Duty Type "THD", cover interlocked with operating handle so that cover cannot be opened with switch in closed position and switch cannot be closed with cover in open position. 240V or 480V rating, single or multi-pole as required or as noted on drawings, in Nema 1 enclosure indoors or Nema 3R enclosure outdoors unless otherwise noted. Provide dual element motor circuit fuses sized as recommended by equipment manufacturer (for final equipment actually installed).

2. Code required disconnects: Provide a local disconnect in addition to the branch circuit protection device for all equipment as required by code (whether shown or not). Disconnects shall consist of a motor rated switch (or disconnect) for all motor loads less than 3/4HP or other suitable disconnect sized to match branch circuit conductors and load current of equipment, with number of poles as required.

B. Lugs and Connectors: Thomas and Betts "lock-tite", for No. 4 and larger wire; "Scotchlock" fixed spring type with insulator for No. 6 and smaller wire.

1. All splices made up with wire nut connectors shall be solidly twisted together with electricians pliers before connector is installed to ensure a proper connection in the event of wire nut failure. No exceptions.

2. Connectors listed or labeled for “no wire twisting required” are not an acceptable substitute for actual wire twisting.

3. Utilize porcelain type connectors in all high temperature environments (above 105 degrees Celsius).

C. Splice Insulation: "Scotch" electrical tape with vinyl plastic backing or rubber tape with protective friction tape for interior work.

1. Provide watertight cast splices for all conductors in site pull boxes or wet locations.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

B. Fire stopping: 3M Fire Protection Products or equal.

1. Fire-rated and smoke barrier construction: Maintain barrier and structural floor fire and smoke resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound vibration absorption, an at other construction gaps.

2. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall penetrations. Systems or devices must be asbestos free.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:
   1. Overhead-line grounding.
   2. Underground distribution grounding.
   3. Ground bonding common with lightning protection system.

1.2 SUBMITTALS

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

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Ground rods.
   3. Ground rings.
   4. Grounding arrangements and connections for separately derived systems.
   5. Grounding for sensitive electronic equipment.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on NFPA 70B.
      a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
      b. Include recommended testing intervals.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
   1. No. 4 AWG minimum, soft-drawn copper.
   2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 3/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install two parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by CEC:
1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by CEC, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
   1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
   3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least [three] rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
   1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect

grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install copper bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260527
GROUNDING

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 shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.3 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.

C. Qualification data for firms specified in "Quality Assurance" Article to demonstrate their capabilities and experience.

D. Field tests and observation reports certified by the testing organization and indicating and interpreting the test reports for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the InterNational Electrical Testing Association (NETA).

1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Comply with UL 467.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chance: A. B. Chance Co.
2. Erico Inc.; Electrical Products Group.
3. Galvan Industries, Inc.
4. Lyncole XIT Grounding.
5. Raco, Inc.
6. Thomas & Betts, Electrical.

2.2 GROUNDING AND BONDING PRODUCTS

A. Where types, sizes, ratings, and quantities indicated are in excess of California Electrical Code (CEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS

A. Conform to CEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper.

B. Equipment Grounding Conductors: Insulated with green color insulation.

C. Grounding-Electrode Conductors: Stranded cable.

D. Isolated Grounding Conductors: Insulated with green color, yellow striping insulation.

E. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.4 MISCELLANEOUS CONDUCTORS

A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Bonding Straps: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.5 CONNECTOR PRODUCTS

A. Grounding connections shall be exothermic welded, bolted clamp terminal, or pressure connector type.

B. Exothermic-Welded Connections shall be provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

C. Bolted Clamp connectors shall be heavy-duty type.

D. Pressure connectors shall be high-conductivity-plated units.

2.6 GROUNDING ELECTRODES AND TEST WELLS

A. Grounding Rods shall be sectional type; copper-clad steel.

1. Size: 3/4 inch by 120 inches.

B. Plate Electrodes shall be copper, square or rectangular shape. Minimum 0.10 inch thick, size as indicated.

C. Test Wells shall consist of a Christy Concrete Products F8 Box, or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. The conduit system, supports, cabinets, switchboards, etc., and neutral conductors must be permanently and effectively grounded by means of approved ground clamps, in accordance with Title 24 of the California Code of Regulations. The neutral shall only be grounded at the main service location unless specifically noted otherwise on the drawings or required by the California Electrical Code.

B. This Contractor shall exercise every precaution to obtain good contacts at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduits shall be bonded around the boxes with a #6 AWG gauge, THWN wire with ground clamps.

C. Where there is more than one building supplied from a common service, provide a grounding electrode system at each building per CEC 250.50 and connect per CEC 250.32(B)(1).

3.2 APPLICATION

A. General

1. All equipment cases, motor frames, etc. shall be completely grounded to satisfy applicable code requirements.

2. The interior hot and cold water piping and the interior above ground gas piping shall be bonded to the building service equipment per CEC 250.104.

3. Do not use underground gas piping as a grounding electrode.

B. Equipment Grounding Conductor

1. Pull an Equipment Grounding Conductor, insulated green, in all conduits, both metallic and non-metallic, unless they are designated for telephone or data cables.

2. Each disconnect switch shall have an Equipment Grounding Conductor (lay in wire type) which shall be used for grounding the disconnect enclosure. The ground wire shall continue and be connected to the enclosure of the equipment served.

3. Comply with CEC Article 250 for types, sizes, and quantities of Equipment Grounding Conductors, except where specific types, larger sizes, or more conductors than required by CEC are indicated.

4. Install separate Equipment Grounding Conductor in branch circuit runs from computer area power panels or power-distribution units.

C. Metal Poles Supporting Outdoor Lighting Fixtures

1. Ground pole to equipment grounding conductor run with supply branch circuit.

3.3 INSTALLATION

A. General: Ground electrical systems and equipment according to CEC requirements, except where Drawings or Specifications exceed CEC requirements.

B. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.

1. Drive until tops are 2 inches below finished floor or final grade, except as otherwise indicated.

2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.

C. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches below grade.

E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.

F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.

G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

H. Test Wells: One for each driven grounding electrode, except as otherwise indicated. Set top of well flush with finished grade or floor. Fill with 1-inch- maximum-size crushed stone or gravel.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC Paragraph 250.52(A)(3), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. Where base of concrete foundation is less than 20 feet in length, coil excess conductor within base of concrete foundation. Bond grounding conductor to reinforcing steel to at least 4 locations, and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.4 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's

written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Non-contact Metal Raceway Terminations: Where metallic raceways or metallic sheathed cables terminate at metal housings without mechanical and electrical connection to the housing, terminate each metallic raceway or metallic sheathed cable with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits or sheathed cables at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

A. Refer to Specification Section 260800 for minimum required testing of Grounding System.

3.6 ADJUSTING AND CLEANING

A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 02 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 260526

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

B. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.

2. Steel slotted channel systems. Include Product Data for components.

3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Comply with CEC.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.

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

c. ERICO International Corporation.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.

g. Wesanco, Inc.

h. General Electric Company

i. Republic Steel Corporation

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by CEC. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts

6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 Section "Exterior Paints" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

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

END OF SECTION

SECTION 260533
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface and buried raceways, wireways, outlet boxes, pull boxes, junction boxes, hand holes and concrete manholes.

1.2 RELATED SECTIONS

A. Section 260500: Common Work Results for Electrical

B. Section 260519: 600-Volt Power Conductors and Cables

C. Section 260526: Grounding and Bonding for Electrical Systems

D. Section 260553: Identification for Electrical Systems

1.3 REFERENCES - CODES AND STANDARDS

A. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated.

C. ANSI C80.6 American National Standard for Electrical Intermediate Metal Conduit.

D. ASTM A 48 Standard Specification for Grey Iron Castings.

E. NECA (National Electrical Contractor's Association) – "Standard of Installation."

F. NEMA FB 1 (National Electrical Manufacturers Association) – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

G. NEMA OS 1 (National Electrical Manufacturers Association) – Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

H. NEMA OS 2 (National Electrical Manufacturers Association) – Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

I. NEMA RN 1 (National Electrical Manufacturers Association) – Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

J. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit.

K. NEMA TC 3 (National Electrical Manufacturers Association) – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

L. NEMA TC 6 - Non-Metallic Conduit.

M. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for Electrical Equipment (1,000 Volts Maximum).

N. CEC California Electrical Code (CEC). Latest approved edition

O. UL 1 Flexible Metal Conduit

P. UL 6 Rigid Metal Conduit

Q. UL 514B Conduit, Tubing and Cable Fittings.

R. UL 651 Rigid Non-Metallic Conduit

S. UL 797 Electrical Metallic Tubing

T. UL 1242 Intermediate Metal Conduit

1.4 SYSTEM DESCRIPTION

A. All branch circuits for electrical equipment, receptacles and lighting shall be copper wiring routed in EMT conduit. PVC conduit and MC Cable are not allowed, unless otherwise noted.

B. Raceway, boxes and manholes located as indicated on drawings and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway, boxes and manholes are shown in approximate locations unless dimensioned. Provide raceway for complete wiring system.

C. Underground more than 5 feet (1,500 mm) outside foundation wall: Provide Schedule 40 non-metallic conduit.

D. Underground within 5 feet from foundation wall: Provide rigid steel or Schedule 40 non-metallic conduit.

E. In or Under Slab on Grade: Provide Schedule 40 non-metallic conduit encased in concrete. Provide Galvanized with tape wrap rigid steel factory bends greater than 22.5 degrees and for stub-ups through concrete slabs.

F. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.

G. In Slab above Grade: Provide galvanized rigid steel conduit. Provide cast or concrete-tight sheet metal boxes.

H. Exposed Dry Locations: Provide galvanized rigid steel conduit. Provide cast boxes.

Concealed Dry Locations: Provide electrical metallic tubing for sizes less than 2-inches. Provide galvanized rigid steel or intermediate steel conduit in sizes 2-inches or larger. Provide cast or sheet metal boxes.

1.5 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch (19 mm) unless otherwise specified.

1.6 SUBMITTALS

A. Manufacturer’s Installation Instructions: Submit application conditions and limitations of use stipulated by product testing agency having jurisdiction. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

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.

C. Product Data: Submit for the following:

1. Rigid Steel Conduit.

2. Electrical Metallic Tubing (EMT).

3. Liquid tight flexible metal conduit.

4. Nonmetallic conduit.

5. Raceway fittings.

6. Conduit bodies.

7. Surface raceway.

8. Pull boxes, junction boxes.

D. Manufacturer's Installation Instructions:

1. Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

2. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents:

1. Record actual routing of conduits. Provide record (as-built) drawings marked in red to show actual routing of the underground raceway and cable when different from the original contract drawings. Prepare on new, clean set of contract drawings.

2. Record actual locations and mounting heights of outlet, pull boxes, junction boxes and manholes.

1.8 DELIVERY, STORAGE, AND HANDLING

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC and PVC-coated metallic conduit from sunlight.

PART 2 - PRODUCTS

2.1 CONDUIT

A. 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.

B. 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.

C. 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.

D. 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.

2.2 RACEWAY FITTINGS

A. Couplings and Thread Protectors. Each length of threaded conduit shall be provided complete from the manufacturer with a coupling on one end and a thread protector on the other. The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage.

B. Metal Conduit Fittings shall conform to the requirements of UL 514B where this standard applies. Galvanized steel fittings shall be used with steel conduit. Threaded fittings shall engage a minimum of five threads made up wrench-tight and be compatible with conduit. EMT fittings shall be compression type, UL approved for rain tight applications.

C. Liquid-Tight Flexible Conduit Fittings shall be galvanized steel, T&B 53XX series insulated throat, and shall bear the UL label. Die-cast malleable fittings are not acceptable.

D. Non-Metallic Conduit Fittings shall be of same material and strength characteristics as the conduit and shall be solvent welded as recommended by manufacturer. End bells shall be plastic, high impact, tapered to fit. Where conduit transition from non-metallic to metallic is required, provide non-metallic female “terminal” adapter. Non-metallic “male” adapters are not acceptable.

E. Bushings shall be provided for the termination of all conduits not terminated in hubs, couplings or insulated throat connectors. Grounding type insulated bushings with insulating inserts in metal housings shall be provided for conduit 1-1/4 inches and larger. Standard bushings shall be galvanized steel or malleable iron in all sizes.

F. Locknuts. One interior and one exterior locknut shall be provided for all conduit terminations not provided with threaded hubs and couplings. Locknuts shall be designed to securely bond with the conduit to the box when tightened. Locknuts shall be so constructed that they will not be loosened by vibration.

2.3 CONDUIT BODIES

A. Aluminum conduit bodies shall be die-cast copper-free aluminum alloy A360. Aluminum conduit bodies shall be finished with powder-coated paint. Cover shall be die-cast or stamped aluminum or steel.}

B. Malleable iron conduit bodies shall be cast malleable iron with tensile strength meeting ASTM A 48, Class 30A requirements. Malleable conduit bodies shall be finished with an epoxy powder coating. Cover shall be malleable iron with captive screws.

C. All conduit bodies' entrances shall be machined NPT threads with a smooth, rounded, internal conduit stop bushing.

D. All conduit bodies shall be equipped with a sealed and gasketed cover. Cover shall be secured using stainless steel machine screws.

E. Conduit bodies shall be manufactured by Crouse-Hinds, Appleton, or approved equal.

2.4 CONDUIT SUPPORTS

A. Conduit supports shall be furnished and installed in accordance with other section of these specifications. Conduits shall be supported so that fittings are accessible. Support systems shall be limited to electrical conduits only.

B. Hanger rods shall be 3/8-inch diameter galvanized threaded steel rods, minimum. Conduit racks over 18-inch wide, over one level, or supporting 2-inch RSC or larger, shall be 1/2-inch diameter rod minimum.

C. Conduit Clamps. Conduits in single runs or groups of two shall be supported by steel clamps and clamp backs. They shall be galvanized malleable iron or approved equal cast ferrous metal for steel conduit or tubing.

D. Support Channels. Supports for banks of three of more conduits shall be constructed of formed steel support channels (Unistrut, Kindorf, Superstrut, B-Line or approved equal) with associated conduit or tubing clips. Support channels shall be steel, hot-dip galvanized after fabrication with galvanized steel clips for steel conduit or tubing.

E. Wall Penetrations. All conduits, raceways, cables and sleeve penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed with a UL-approved fire stopping system, in accordance with specification Section 16060 – Basic Electrical Materials and Methods.

2.5 OUTLET BOXES AND SWITCH BOXES

A. Manufacturers: Firms regularly engaged in the manufacturing of electrical raceways of the types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized flat rolled sheet steel outlet wiring boxes of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

C. Outlet boxes used in wet outdoor locations, surface mounted shall be cast metal (FS or FD type) with mounting lugs and gasketed covers.

D. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported, per CEC requirements.

E. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for Supporting outlet boxes, which are compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.6 PULL BOXES, JUNCTION BOXES, HANDHOLES AND MANHOLES

A. Sheet Metal Boxes shall be NEMA OS 1, NEMA rating as indicated on drawings. Minimum 16 gauge galvanized steel construction with stainless steel hinged cover and neoprene gasket. Cover shall be secured to the body with a continuous, full length, piano type hinge and stainless steel pin on one side and captive screw on the other side. Door shall be equipped with padlock hasp with sealing hole provisions.

1. Provide #10-32 tapped hole provisions for optional ground lug kit.

2. Provide 0.375-16 collar studs for mounting optional panel.

3. Provide external mounting feet for secure wall mounting.

4. Finish: Wash and phosphate undercoat with ANSI 61 gray polyester power finish.

B. Surface-Mounted Cast Metal Box: NEMA 250, NEMA Type 3R or 4 as indicated, flat-flanged, surface-mounted junction box:

1. Material: Cast Iron.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

2.7 CLOSURE FOAM

A. All conduit, raceways, cables and sleeves penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed by closure foam as in Dow Corning #3-6548 silicone RTV, GE RTV 850 silicone foam, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough in.

3.2 INSTALLATION OF RACEWAYS

A. Routing

1. Install raceway and boxes in accordance with NECA “Standard of Installation.”

2. Conduit routing shown on drawings is diagrammatic only. Contractor shall field route conduit and raceways between equipment and devices as required to obtain a complete wiring system.

3. Conduit shall not be exposed unless specifically mentioned on the drawings or accepted by the architect.

4. All exposed conduits shall be installed parallel or perpendicular to dominant surfaces with right-angle turns made of symmetrical bends or fittings.

5. Conduit shall not be installed on the outside face of exposed columns, but shall be routed on the web or on the inside of a flange of the column.

6. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.

7. Conduit shall be located at least 6 inches from hot water or steam pipes and from other hot surfaces

B. Moisture Pockets

1. Moisture pockets shall be eliminated from conduits. If water cannot drain to the natural opening in the conduit system, a hole shall be drilled in the bottom of a pull box or a "C-type" conduit fitting provided in the low point of the conduit run.

C. Couplings and Unions

1. Metal conduit shall be joined by threaded conduit couplings, with the conduit ends butted.

2. The use of running threads, Erickson type couplings, split couplings or similar unions are not permitted.

D. Conduit Bodies

1. Conduit bends shall meet the requirements of CEC, minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.

2. Conduits or tubing deformed or crushed in any way shall be removed from the job site.

E. Bends and Offsets

1. Changes in direction of conduits shall be made with fittings or bends.

2. Conduit bends shall meet the requirements of CEC, minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.

3. Bends shall be made using appropriate tools or mechanical equipment. The use of a pipe tee or vise for bending conduit or tubing will not be permitted.

4. For non-metallic conduit or plastic coated steel, approved factory bends and offsets shall be used.

5. Conduits or tubing deformed or crushed in any way shall be removed from the job site.

6. Install no more than the equivalent of three 90 degree bends between boxes or outlets

F. Cutting and Threading

1. The plane of all conduit ends shall be square with the centerline.

2. Where threads are required, they shall be cut and cleaned prior to conduit reaming.

3. The ends of all conduit and tubing shall be reamed to remove all rough edges and burrs.

4. Cutting oil shall be used in threading operations; the dies shall be kept sharp, and provisions shall be made for chip clearance.

5. Threads on conduits and fittings shall be lubricated with conducting and sealing compound.

6. All steel conduits shall be coated after threading with cold-galvanized zinc coating. The Contractor shall supply this protective material and shall apply it in the field prior to installing conduit or fittings.

G. All steel conduit, exposed to weather or in contact with earth, shall be re-galvanized after threading with "Galvanizing Powder M-321" as manufactured by the American Solder and Flux Company of Philadelphia, Pennsylvania; "Zincilate 810" as manufactured by Industrial Metal Protectives, Inc., of Dayton, Ohio; "Zinc Rich" coating as manufactured by ZRC Chemical Products Company, Quincy, Massachusetts; or approved equal. The Contractor shall supply this protective material and shall apply it in the field.

H. Connections to Boxes and Cabinets

1. Conduit shall be securely fastened to all boxes and cabinets.

2. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit.

3. The locknuts, both inside and outside, shall then be tightened sufficiently to bond the conduit securely to the box.

4. Locknuts on connectors shall be tightened securely to bond the connectors.

I. All conduits entering enclosures outdoors or in wet areas shall enter through Meyer's hubs, or approved equal, or threaded openings.

J. Cleaning

1. Precautions shall be taken to prevent the accumulation of water, dirt, or concrete in the conduit.

2. Conduit in which water or other foreign materials have been permitted to accumulate shall be thoroughly cleaned or, where such accumulation cannot be removed by methods acceptable to the Owner /Engineer, the conduit shall be replaced.

3. For conduits sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of foreign materials. For conduits less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles and foreign material.

K. Empty Conduit

1. All conduits installed for future use shall have a polypropylene pull line with a minimum tensile strength of 200 lbs., Jet Line, Cat. No. 232, polyolefin, or approved equal. Pull line shall be secures at both ends to ensure future accessibility.

L. Rooftop Conduits

1. Provide redwood sleepers on waterproof mastic base for all conduit runs exposed on roofs.

M. Identification

1. All conduits shall be identified in accordance with other section of these specifications.

N. Grounding

1. All conduits shall be grounded in accordance with specification Section 16050 – Basic Electrical Materials and Methods.

2. A solid or stranded bare copper or green insulated copper solid or stranded ground wire shall be provided in all conduits and raceways.

O. Galvanized Rigid Steel Conduit

1. Galvanized rigid steel conduit shall be installed in areas exposed to weather, vehicle traffic, in hazardous classified areas, for penetrations through foundations, and 10 feet before transition from below grade to 8 feet above grade, unless otherwise noted on the drawings.

2. Steel conduit in contact with earth shall be protected by "Scotchwrap" 10 mil tape applied in double thickness using 50 percent lap turns to 6 inches above grade and 6 inches beyond transition.

3. Expansion joints shall be used where required.

P. Polyvinyl Chloride (PVC) Coated Galvanized Rigid Steel Conduits and Intermediate Steel Conduit

1. PVC -coated, steel conduit and fittings shall be installed where highly corrosive conditions exist, indoors or outdoors.

2. The Contractor shall patch any damaged coating according to the manufacturer's instructions.

Q. Electrical Metallic Tubing

1. Electrical metallic tubing shall be installed for all circuits, indoors above concrete slab, where not subject to conditions outlined for rigid galvanized steel conduits.

R. Liquid-Tight Flexible Metal Conduit

1. Liquid-tight flexible metal conduit shall be used in place of regular flexible conduit for connections to motors and transformers, in areas exposed to weather, moisture or oil, and under raised floors.

2. Liquid-tight flexible metal conduit may be used in place of flexible metal conduit where not otherwise required.

S. Non-Metallic Conduit

1. Schedule 40 shall be used for all power, signal feeders and branch circuits, in earth or enclosed in concrete, unless otherwise noted on the drawings. Conduits must be buried in earth in accordance with the CEC.

T. Conduit Support

1. Fasten conduit supports to building structures and surfaces in accordance with Section 16050 – Basic Electrical Materials and Methods.

2. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

3. Do not use wire, ceiling support wires or perforated pipe straps to support conduit. Remove any temporary installation support wire.

U. Spacing of Supports

1. All conduit runs shall be rigidly supported, except where buried in concrete,.

2. Each conduit shall be supported within one (1) foot of junction boxes and fittings.

3. Spacers used in duct bank installations shall be placed no more than 6 to 10 feet apart.

4. Support spacing along conduit runs shall be as follows.

Conduit Size	Maximum Distance Between Supports
½ Inch Through 1-1/4 Inch	5 Feet
1-1/2 Inch And Larger	8 Feet

V. Ground and bond raceway and boxes in accordance with Section 16050 – Basic Electrical Materials and Methods.

3.3 CABINET AND BOX INSTALLATION

A. Install electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Locate boxes and conduit bodies so as to ensure ready accessibility of electrical wiring, maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. In inaccessible ceiling areas, install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices with each other.

E. Use flush mounting outlet boxes in finished areas.

1. Do not install flush mounting boxes back-to-back in walls.

2. Provide minimum 6-inch separation between adjacent boxes.

3. Provide minimum 24-inch separation in acoustic rated walls.

4. Use stamped steel bridges to fasten flush mounting outlet box between studs.

5. Secure flush mounting box to interior wall and partition studs.

6. Accurately position to allow for surface finish thickness.

7. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

8. Use adjustable steel channel fasteners for hung ceiling outlet box.

F. Support boxes independently of conduits.

G. Use code sized gang box where more than one device is mounted together. Do not use sectional box. Use code sized gang box with plaster ring for single device outlets.

H. Use cast outlet box in exterior locations where exposed to the weather and wet locations (interior or exterior).

I. Coordinate installation of electrical boxes and fittings with cable and raceway installation work. Provide knockout closures to cap unused knockout holes where blanks have been removed.

J. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections where fastened with a locknut or bushing on rounded surface.

K. Fasten boxes rigidly to substrate or structural surfaces to which they are being mounted, or solidly embed electrical boxes in concrete or masonry as appropriate.

L. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.

M. Conduit openings in boxes shall be made with a hole saw or shall be punched.

N. Cabinets and boxes shall be rigidly mounted.

1. Mounting on concrete shall be secured by self-drilling anchors.

2. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both.

3. Cabinets shall be leveled and fastened to the mounting surface with not less than ¼-inch air space between the enclosure and mounting surface.

4. All mounting holes in the enclosure shall be used.

O. Large Pull Boxes - Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.

1. Interior Dry Locations - Use hinged enclosure.

2. Other Locations - Use surface mounted box of appropriate location classification.

3.4 ANCHORS

A. Where supports for raceways, boxes, and cabinets are mounted on concrete surfaces, they shall be fastened with self-drilling tubular expansion shell anchors with externally split expansion shells, single-cone expanders, and annular break-off grooved chucking cones. Anchors shall be Phillips "Red Head" or Approved equal.

3.5 ADJUSTING

A. Install knockout closures in unused openings in boxes.

3.6 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore manufacturer’s finish.

END OF SECTION

SECTION 260544
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.2 SUMMARY

A. Section Includes:
1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.

2. Sleeve-seal systems.

3. Sleeve-seal fittings.

4. Grout.

5. Silicone sealants.

B. Related Requirements:

1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.

2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches thickness shall be 0.052 inch.

b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.

b. CALPICO, Inc.

c. Metraflex Company (The).

d. Pipeline Seal and Insulator, Inc.

e. Proco Products, Inc.

2. Sealing Elements: Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel.

4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59,

B. Subpart D (EPA Method 24).

1. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various

C. Sources Using Small-Scale Environmental Chambers."

D. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. . Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior/interior concrete walls and slabs-on-grade at raceway entries into building or as shown on drawings.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

B. Secure nailing flanges to concrete forms.

C. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 260548
SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

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. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts. Qualification Data: For qualified testing agency and testing agency's field supervisor.

B. Related Requirements:
1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.

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

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction.

Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with CEC.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

1. Building Classification Category: III.

B. Seismic-Restraint Loading:
1. Site Class as Defined in the CBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the CBC: III.
    a. Component Importance Factor: 1.0.
    b. Component Response Modification Factors:
        1) Panel boards, instrumentation cabinets: 6.0.
        2) Lighting fixtures: 1.5.
        3) Communication equipment: 2.5.
        4) Electrical conduit and cable trays: 6.0
    c. Component Amplification Factors:
        1) Panel boards, instrumentation cabinets: 2.5.
        2) Lighting fixtures: 1.0.
        3) Communication equipment: 1.0.
        4) Electrical conduit and cable trays: 2.5
3. Design Spectral Response Acceleration at Short Periods (0.2 Second).
4. Design Spectral Response Acceleration at 1.0-Second Period.

2.2 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

A. Restraint Cables: ASTM A 603 galvanized steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.6 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

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

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:
   1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
   2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install cables so they do not bend across edges of adjacent equipment or building structure.

C. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

E. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.

C. Seismic controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of the electrical systems and equipment requiring identification is shown on the drawings, and the extent of identification required is specified herein and in individual sections of work requiring identification. The types of electrical identification specified in this section include the following:
   1. Exposed conduit color banding.
   2. Cable/conductor identification.
   3. Operational instructions and warnings.
   4. Equipment/system identification signs.

1.2 REFERENCES- CODES AND STANDARDS

A. ANSI Z535.1 - Safety Color Code

B. APWA ULCC - Uniform Color Code for Buried Utilities.

C. CEC California Electrical Code (CEC). Latest approved edition.

1.3 SYSTEM DESCRIPTION

A. Label the following electrical equipment with nameplates which clearly identify each item, the function or use of the item, and the circuit identification of the feed to the item:

1. All transformers shall be identified by 1-inch high block letters cut in stencil and applied with yellow paint on a flat-black background. The transformer number, primary and secondary voltages, and the kVA shall be shown.

2. All Distribution Panelboards, Power and Lighting Panels, Local Control Panels, Terminal Cabinets and all electrical equipment enclosure shall be identified using laminated plastic nameplates. The equipment number, voltage rating, current rating, number of phases, connection type, short circuit interrupting rating, and circuit number shall be shown.

3. All motors, starters, disconnect switches, Time Switches, Special Function Pushbuttons and Switches, and miscellaneous control devices shall be identified by function and circuit number, with 1/4-inch high black characters on a ½-inch wide white stick-on tape where installed indoors and engraved plastic nameplates where installed outdoors.

4. All underground raceway or cable shall be marked with buried warning tape along its entire length.

5. All exposed raceway longer than 10 feet in length shall be identified.

6. Panelboard Directories: Furnish all panelboards with a complete typewritten directory mounted in the inner door under a clear plastic cover set in a metal frame.

B. Branch circuits and devices:

1. Label all individual receptacle outlets and light switches at their faceplate to indicate the panelboard of origin and branch circuit number, as shown on drawings. Labels shall be self adhesive, thermal machine printed type such as Brothers, Panduit, or T&B and shall be clear plastic with black lettering.

2. All branch circuits in outlet boxes shall be identified with circuit number using wrap-around labels (T&B, BRADY or 3M).

3. As an alternative to separate nameplates, device plates may be engraved directly with lettering filled with black enamel.

1.4 SUBMITTALS

A. Catalog data for nameplates, labels, and markers.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of CEC – California Electrical Code.

B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or other recognized, approved testing and listing agencies as suitable for the purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates

1. Engraved three-layer laminated plastic, white letters on black background for normal power and white letters on red background for emergency power. Communications and control cabinets shall be labeled with white letters on green background.

2. Locations

a. Each electrical distribution board, panelboard and control equipment enclosure.

b. Communication cabinets.

3. Letter Size

a. Use 1/8-inch letters for identifying individual equipment and loads.

b. Use ¼-inch letters for identifying grouped equipment, loads, panelboards, and transfer switches.

c. Use ½-inch letters for identifying the main switchboard, motor control centers, transformers and large distribution switchboards.

B. Labels

1. Embossed adhesive tape, with 3/16-inch white letters on colored background to match color scheme of plastic laminate labels in 2.1.1. Use only for identification of individual wall switches and receptacles, control device stations, and multi-outlet devices.

2. Thickness

a. 1/16-inch for units up to 20 square inches or 8-inch length; 1/8-inch for larger units.

2.2 WIRE MARKERS

A. Manufacturers

1. Brady

2. Thomas & Betts

3. 3-M Co.

B. Description: Cloth, tape, split sleeve, or tubing type wire markers, self-adhesive.

C. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, control panels, motor controllers and starters, and each load connection.

D. Legend

1. Power and Lighting Circuits: Branch circuit or feeder feed from.

2. Control Circuits: Control wire number indicated on shop drawings.

3. Neutral Conductors: Clearly indicate the branch circuit or feeder number the neutral serves. In multi-wire circuits where the neutral is shared, mark the neutral with the circuit number of the “A” phase.

2.3 CONDUIT MARKERS

A. Provide manufacturer's standard preprinted, flexible or semi-rigid, permanent, plastic-sheet conduit markers, minimum of 3 mils thick and 1-1/2-inch wide extending 360 degrees around conduits; designed

for self-adhesive attachment to conduit. Except as otherwise indicated, provide lettering that indicates the voltage of the conductor(s) in the conduit. Provide 8-inch minimum length for 2-inch and smaller conduit, 12-inch minimum length for larger conduit.

B. Location: Furnish markers for each conduit longer than 10 feet.

C. Spacing: 20 feet on center.

D. Color: Unless otherwise indicated or required by governing regulation, provide orange markers with black letters.

1. Fire Alarm System: Red w/black letters.

2. Telephone System: Green w/yellow letters.

3. Data/Communication. System: White w/black letters.

4. Emergency System: Orange w/black letters.

E. Legend:

1. 208 Volt System: Normal 208/120-volts.

2. Fire Alarm System: Fire alarm.

3. Telephone System: Telephone.

4. Data/Communication System: Data/communications.

2.4 FASTENERS

A. Secure all labels and nameplates with self-tapping stainless steel screws. Use contact type permanent adhesive where screws cannot or should not penetrate the substrate.

2.5 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in the electrical identification work, with the corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.

2.6 UNDERGROUND WARNING TAPE

A. Three-inch minimum width, 5 mil thickness, foil bonded polyethylene tape, detectable type, with suitable continuous warning legend describing buried electrical lines. Tape color shall conform to APWA uniform color code using ANSI Z535.1 safety colors. Text shall be black, 2-inch minimum letters.

B. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

B. Coordination: Where identification is to be applied to surfaces that require finish, install identification after completion of painting.

C. Regulations: Comply with governing regulations and the requests of governing authorities for the identification of electrical work.

3.2 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws, rivets, or adhesive.

C. Secure nameplate to outside moveable surface of door on panelboard.

D. Conduit Identification:
1. Where electrical conduit is exposed in spaces with exposed mechanical piping, which is identified by a color-coded method, apply color-coded identification on the electrical conduit in a manner similar to the piping identification. Except as otherwise indicated, use orange as the coded color for conduit.
2. Paint red band or provide red tape on each fire alarm conduit longer than 10 feet, minimum 20 feet on center.

E. Cable/Conductor Identification:
1. Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where the wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided.
2. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project electrical work.

F. Operational Identification and Warnings
1. Wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems, and electrically connected mechanical systems and general systems and equipment, including the prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes.

END OF SECTION

SECTION 260800
COMMISSIONING OF ELECTRICAL SYSTEMS

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 shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. This Section defines Commissioning of Electrical Systems including electrical acceptance tests and checks that shall be made on all electrical equipment and wiring to ensure compliance with all applicable Codes and Standards, and with the requirements of the Contract Documents.

B. All electrical equipment testing and related costs shall be included in the Contractor's bid.

1.3 GENERAL REQUIREMENTS

A. The Contractor shall test equipment of all kinds installed on this project to determine whether it fulfills the requirements of these Specifications. The Contractor shall furnish all labor necessary to adjust the operation of the apparatus and make the connections for the tests. After the tests have been completed, the Contractor shall restore all connections, apparatus, etc., to their original condition.

B. The Contractor shall retain the services of a qualified Independent Testing Agency holding a valid current C-10 License to perform certain tests and prepare reports, as enumerated in the following Articles. The Independent Testing Agency shall be a company that specializes in electrical equipment testing and shall be NETA or NICET certified.

C. Contractor shall obtain approval from the architect of proposed independent testing agency(s) before any testing is started.

D. Electrical systems, equipment and materials shall be tested prior to final acceptance of the work.

1.4 INDEPENDENT TESTING AGENCY REQUIREMENTS

A. The Independent Testing Agency shall furnish personnel acceptable to Engineer to conduct testing. Supervising engineer shall have a minimum of five years experience in testing of equipment of the type to be tested on this Project.

B. The Independent Testing Agency shall furnish all labor required for and incidental to testing.

C. The Independent Testing Agency shall provide minor field repairs, adjustments, and wiring modifications at the time of inspection and testing.

D. The Independent Testing Agency shall furnish all necessary test equipment to satisfactorily perform all tests specified herein.

E. The Independent Testing Agency shall check all devices for proper operation - checking for wear, tightness, dirt, etc.

F. The Independent Testing Agency shall check for conformance to published curves.

G. The Independent Testing Agency shall notify and coordinate with the Owner's representative at least 3 working days prior to the commencement of any Electrical Acceptance Testing. Tests shall be witnessed by the Owner's representative unless such witnessing is waived in writing by the Owner's Representative.

1.5 CODES AND STANDARDS

A. 2022 California Electrical Code (CEC).

B. National Electrical Manufacturer's Association (NEMA).

C. Manufacturer's Instructions and Maintenance Manual applicable to each particular apparatus.

D. OSHA Rules and Regulation.

E. National Electrical Testing Association (NETA) "Acceptance Testing Specifications".

F. Procedures as directed by Engineer.

1.6 CARE AND PRECAUTIONS

A. Contractor shall be responsible for any damage to equipment or material due to improper test procedures or test apparatus handling, and shall replace or restore to original condition, any damaged equipment or material.

B. Contractor shall furnish and use safety devices such as rubber gloves and blankets, protective screens, barriers, and danger signs to adequately protect and warn all personnel in the vicinity of the tests.

1.7 EQUIPMENT TO BE TESTED BY CONTRACTOR

A. Perform the visual inspections, manual operations and tests on systems and equipment as described in Part 3, "Execution".

B. Switchboard

C. Molded Case Circuit Breakers Rated Less Than 100A

D. Power Cable

E. Lighting

F. Title 24 Acceptance Testing

1.8 EQUIPMENT TO BE TESTED BY INDEPENDENT TESTING AGENCY

A. Circuit Breakers Rated 100A and Greater

B. Grounding System

C. Switchboard

1.9 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Test Reports

1. Provide written test reports, signed and dated, for all tests prior to acceptance of the tested equipment by the Owner.

2. Submit certified reports of Independent Tests and Observations indicating and interpreting test results specified in Part 3 of this Section.

a. The Test Report shall include the following:

1) Description of equipment tested.

2) Description of test procedure.

3) Calibration record for all testing devices used.

4) Test results.

5) Recommendations.

6) Appendix, including all field test reports.

b. Furnish completed reports to the Electrical Engineer no later than ten days after test completion unless requested otherwise by Owner.

c. Instrumentation-Traceability: The testing agency shall provide calibration labels for all relays and circuit breakers tested.

d. Labels shall be self-adhesive and placed on covers or frames so as not to obscure nameplate, tap block or time dial. Label shall indicate date tested and firm name.

PART 2 - PRODUCTS

2.1 TESTING EQUIPMENT

A. Furnish suitable electrical instruments including voltmeters, ammeters, wattmeters, tachometers and all other equipment necessary to perform tests specified.

B. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment and devices necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.

2.2 TESTING COORDINATION

A. Coordinate activities and cooperate with others on the Project to ensure that systems are energized when required, when loads are applied, and that other requirements of this Section of the Specifications are carried out in a timely, coordinated basis.

B. Conduct tests in the presence of the Construction Manager. Notify the Construction Manager seven calendar days or more in advance when any test is to be performed, and do not start tests without the permission of the Construction Manager.

C. Make up no permanent connections until correct phase sequence of all equipment is determined.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall provide Acceptance Testing on the entire Electrical System. Certain of this testing shall be performed by an Independent Testing Agency as indicated.

B. Acceptance Testing shall include Visual Inspections, Manual Operations, Electrical Tests, and Functional Testing.

C. Whenever possible, all Visual Inspections, Manual Operations and Electrical Tests shall be made just prior to energizing the equipment or circuits, and shall be coordinated with the field schedule and field conditions.

D. Test reports on megger, dielectric absorption and high potential tests shall include the ambient temperature and relative humidity existing at the time of the tests.

E. Should any piece of apparatus or any material or work fail during any of these Tests, it shall be immediately removed and be replaced by perfect material by this Contractor at his expense and the portion of the work replaced be again tested by the Contractor.

F. Before testing and energizing a system, all necessary precautions shall be taken to ensure the safety of personnel and equipment. All conductors and all electrical equipment shall be properly insulated and enclosed. All enclosures for conductors and equipment shall be properly grounded. Insulation resistance measurements must have been made and approved on all conductors and energized parts of electrical equipment.

1. During actual testing, the Contractor or Independent Testing Agency shall:

   a. Ensure that temporary power terminations are connected in such a manner that commercial power may be restored in forty-five minutes upon request.

   b. Place temporary power cables out of the way in a safe manner that provides no hazard to personnel or equipment in the area.

   c. Provide all special connections required.

   d. Conduct all tests in presence of the representative except where advised this would not be necessary.

G. The entire installation shall be free from short circuits and improper grounds. Panels and circuits shall be tested for grounds and shorts with mains disconnected from the feeder, branches connected, lamps removed or omitted from the sockets and all wall switches closed. Each individual circuit shall be tested at the panel with the equipment connected for proper operation

H. The following minimum tests are required, but shall not be limited to this list. Tests will be supervised and witnessed by the Construction Manager:

1. Proper phase rotation.

2. Short circuits.

3. Improper grounds.

4. Power and control electrical circuits for circuit continuity and function test.

I. Furnish all personnel, labor, meters, instruments, cable, connections, equipment and apparatus necessary for making all tests.

J. Check and test all switchboards, transformers, panelboards, feeders, power and control cables, communication system devices and wiring, and all connections to all equipment.

K. After wires and cables are in place and connected to devices and equipment, the system shall be tested for short circuits, improper grounds, and other faults. If fault condition is present, the trouble shall be rectified and the wiring system shall be retested.

L. A voltage test shall be made at each lighting panel, distribution panel and at the last outlet on each circuit. If drop in potential exceeds one percent, correct the condition by locating the ground or high resistance splice or connection and retest.

M. Any wiring device, electrical apparatus, or lighting fixture grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing the defective parts or materials.

N. All final tests shall be witnessed by the Construction Manager and three copies of the verified test results shall be given to the Architect/Engineer and Construction Manager promptly upon completion of a test.

O. Provide assistance to the various equipment manufacturers' field engineers as required in the testing and adjusting of the electrical power and control equipment. Cooperation shall be such that a minimum of time is required for equipment testing.

P. A log shall be maintained for all tests. This log shall be certified before completion of the project, both as to test value and date of test. All major equipment such as the switchboard and panelboards shall be energized initially in the presence of the Construction Manager.

Q. The Owner reserves the right to operate any system or equipment prior to final completion and acceptance of the work. Such preliminary operation shall not be construed as an acceptance of any work. Each piece of equipment and all of the systems shall be adjusted to insure proper functioning and shall be left in first class operating condition.

3.2 VISUAL INSPECTIONS

A. Prior to Manual Operation and Electrical Testing, perform Visual Inspections to verify the following:

1. The equipment is completely and properly installed.
2. The equipment is free from damage and defects.
3. Shipping blocks and restraints have been removed.
4. Electrical terminations have been properly tightened.
5. The equipment has been properly aligned.

6. The equipment has been properly lubricated.

7. The ventilation louvers are open and unobstructed.

8. Voltages and phases have been properly identified.

9. Terminations in control panels have been properly identified.

10. The equipment is ready to be tested

3.3 MANUAL OPERATION

A. Prior to any Electrical Testing, mechanical devices shall be exercised or rotated manually to verify that they operate properly and freely.

3.4 ELECTRICAL TESTS BY CONTRACTOR

A. Switchboard

1. The Contractor shall perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Sections 7.1, 7.6, 7.9, 7.10, 7.11, and 7.14, as appropriate. Certify compliance with test parameters.

2. Switchboard and completed installation shall be inspected for adequate size, bus spacing, bracing, physical damage, proper alignment, anchorage and grounding.

3. Switchboard frame will be inspected for alignment, level, and anchorage.

4. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque value. All bus bolts will be torqued to their proper value. A mark to be placed on each tightened bolt to ensure completeness.

5. Switchboard interior will be vacuumed and wiped clean.

6. The following tests and checks shall be performed before placing in operation:

   a. Check all new bus and cable connections for proper contact pressure and mark each bolt with a red "dot" of paint to indicate it has been checked.

   b. Check all the new equipment for mechanical adjustment, lubrication, and freedom of operation. Remove all shipping blocks.

   c. Operate and test trip units for all new breakers.

   d. Test all transfer switches and associated control circuits for correct connection and operation.

   e. Test all panel feeders and main breakers.

f. Test ground fault systems by operating push-to-test button.

7. Using a Megger, measure the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000VDC. Minimum acceptable value for insulation resistance is one (1) megohm. Refer to manufacturer's literature for specific testing procedure.

B. Molded Case Circuit Breakers rated less than 100A

1. Circuit breakers will be operated manually several times to ensure smooth operation.

2. Molded case will be inspected for cracks.

3. Rated current will be passed through each phase and millivolt readings taken across contacts.

4. Time current characteristic tests will be performed by passing 300% rated current through each phase and monitoring trip time.

5. Instantaneous pickup current will be determined by finding the current level at which the breaker trips out in less than 2 cycles.

6. Insulation resistance tests will be performed at 1000 Volts DC.

7. Circuit breaker covers will be removed on unsealed units and checked for cracks. Interphase barriers and arc chutes to be inspected. All bolts and lugs will be tightened. All internal auxiliary devices will be inspected.

8. Contacts, shunts, etc., will be visually inspected for wear and alignment.

9. Inverse trip time, instantaneous pickup current and millivolt drop across contacts, insulation resistance values, as well as deficiencies causing breaker to function outside published limits will be recorded. Times will then be compared with manufacturer's or NEMA published values.

C. Power Cable

1. The 600-volt insulated wires and cables shall be factory tested prior to shipment in accordance with ICEA Standards for the insulation specified.

2. Perform a continuity check and a 1,000 volt DC megger test on 600 volt power cables No. 6 AWG and larger.

a. The megger test shall be performed between each pair of conductors and from each conductor to ground.

b. The megger test shall be performed for 15 seconds or until the insulation resistance value stabilizes.

c. The insulation resistance between conductors and from each conductor to ground shall be 100 megohms minimum in one minute or less. In addition, the lowest insulation resistance value shall not differ from the highest value by more than 20 percent.

3. Phase conductors, if shorted, grounded or at fault shall be removed, shall be replaced and the wiring system shall be retested.

D. Lighting

1. Upon completion of installation of lighting fixtures and controls, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. The Contractor shall replace at his expense all noisy drivers, broken or cracked lenses or other defective items. Where possible, correct malfunctioning units at site, then re-test to demonstrate compliance; otherwise, remove and replace with new units, and proceed with re-testing.

2. At the time of substantial completion, replace lighting fixtures, which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect or Electrical Engineer.

3. Give advance notice of dates and times for field tests.

4. Provide instruments to make and record test results.

5. Tests and Observations

a. Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source.

b. Check for excessively noisy drivers.

E. Title 24 Acceptance Testing

1. Perform tests as outlined in Part 3 of Specification Section 265600.

3.5 INDEPENDENT AGENCY TESTING

A. Circuit Breakers rated 100A or greater

1. All circuit breakers, 100 amps or more, shall be tested by an independent testing agency in accordance with NETA specifications and a report submitted to the architect. Any circuit breaker that does not pass the test shall be replaced.

2. Circuit breakers will be operated manually several times to ensure smooth operation.

3. Molded case will be inspected for cracks.

4. Rated current will be passed through each phase and millivolt readings taken across contacts.

5. Time current characteristic tests will be performed by passing 300% rated current through each phase and monitoring trip time.

6. Instantaneous pickup current will be determined by finding the current level at which the breaker trips out in less than 2 cycles.

7. Insulation resistance tests will be performed at 1000 Volts DC.

8. Circuit breaker covers will be removed on unsealed units and checked for cracks. Interphase barriers and arc chutes to be inspected. All bolts and lugs will be tightened. All internal auxiliary devices will be inspected.

9. Contacts, shunts, etc., will be visually inspected for wear and alignment.

10. Inverse trip time, instantaneous pickup current and millivolt drop across contacts, insulation resistance values, as well as deficiencies causing breaker to function outside published limits will be recorded. Times will then be compared with manufacturer's or NEMA published values.

11. The testing agency shall provide calibration labels for all relays and circuit breakers tested. Labels shall be self-adhesive and placed on covers or frames so as not to obscure nameplate, tap block or time dial. Label shall indicate date tested and firm name.

B. Grounding System

1. Test shall be performed for every new separately derived AC system.

2. Ground tests shall meet the requirements of the California Electrical Code and comply with UL 467. The grounding electrode system at the main electrical service equipment shall be tested by an Independent Testing Agency in accordance with the three point fall of potential method as specified in IEEE Standard 81-1983. Maximum ground resistance shall be 5 ohms. A copy of the test report shall be submitted to the architect and engineer of record.

3. Maximum grounding to resistance values are as follows:

   a. Equipment Rated 500 kVA and Less: 5 ohms.

   b. Equipment Rated 500 to 1000 kVA: 5 ohms.

   c. Equipment Rated More than 1000 kVA: 3 ohms.

4. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

5. The test agency shall remove the test link between the ground and neutral, and test the neutral for any parallel and/or superfluous ground paths. If any are found, a report should be given to the Engineer. No grounds are to be removed unless authorized in writing.

6. Ground electrode resistance shall be taken using a Biddle ground resistance meter and readings given to the report.

7. All ground connections in switchboard as well as that to cold water pipes shall be check for tightness and adequacy.

8. Measure the resistance to ground of each ground rod [in a ground mat] before connection to the other ground rods. The resistance shall not exceed 10 ohms.

9. Measure the resistance to ground of the total ground system with all connections completed. The resistance shall not exceed 2 ohms for primary services or 5 ohms for secondary services.

10. Tests of the resistance to ground shall be made using either the three point method or the fall-of-potential method.

11. Perform a continuity check from equipment ground bus bars and ground lugs to the ground system.

12. Ground rods for manholes and light poles need not be tested.

13. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

14. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Switchboards and Panels

1. The Independent Testing Agency shall perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Sections 7.1, 7.6, 7.9, 7.10, 7.11, and 7.14, as appropriate. Certify compliance with test parameters.

2. After Substantial Completion, but not more than 2 months after Final Acceptance, The Independent Testing Agency shall perform an infrared scan of each switchboard and panel.

   a. Remove fronts to make joints and connections accessible to a portable scanner.

   b. Use an approved infrared-scanning device designed to measure temperature or detect significant deviations from normal values.

   c. Provide calibration record for device used.

   d. Prepare a certified report identifying switchboards and panels checked and describing results of infrared scanning. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.6 FUNCTIONAL TESTING

A. All automatic and manual functions shall be checked for proper operation.

B. All indicating circuits, lights and alarms shall be tested for correct operation. Burned out indicators shall be re-lamped.

C. Upon completion of the Work, place the entire installation in operation, test for proper function, and show systems and equipment to be free of defects.

END OF SECTION 269500

SECTION 262413
SWITCHBOARDS

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 shall form a part of this Section, with the same force and effect as though repeated here.

1.2 WORK INCLUDED

A. Furnish and install the main switchboard as herein specified.

1.3 REFERENCES

A. The switchboard and overcurrent protection devices referenced herein shall be designed and manufactured according to the following appropriate specifications.

1. 2022 California Electrical Code (CEC).

2. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681

3. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

4. UL 489 - Molded Case Circuit Breakers.

5. UL 891 - Dead-Front Switchboards.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Shop Drawings

1. Submit Shop Drawings for each switchboard indicating front and side enclosure elevations with overall dimensions, conduit entrance locations and requirements, nameplate legends, one-line diagrams, equipment schedule and switchboard instrument details.

C. Test Reports

1. Submit certified reports of Independent Tests and Observations indicating and interpreting test results specified in Part 3 of this Section.

2. Submit calibration record for all testing devices used.

3. Submit certificates, signed by Contractor, certifying that Independent Testing Agency complies with requirements specified in Section 260800.

D. Operation and Maintenance Data

1. Submit operation and maintenance data for switchboards to include in “Operations and Maintenance Instructions” manuals specified in Division 01 and Specification Section 260100, Article 1.6, including detailed manufacturer’s written instructions on adjusting overcurrent protective devices.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Inspect and report concealed damage to carrier within their required time period.

D. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.6 PROJECT CONDITIONS

A. Verify dimensions by field measurements.

B. Determine suitable path for moving switchboard into place considering project conditions.

C. Verify clearance requirements. Locate switchboard to meet installation tolerances.

D. Revise locations and elevations from those indicated as required to suit project conditions.

1.7 WARRANTY

A. Manufacturer shall warrant equipment to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of equipment manufactured by Square D Company. Subject to compliance with project requirements, equivalent products by one of the following manufacturers may be considered:

1. Square D Company
2. General Electric Company
3. Eaton
4. Siemens

2.2 SWITCHBOARD - GENERAL

A. Switchboards shall be rated with a minimum short circuit current rating 65,000 rms symmetrical amperes at 208 VAC maximum. Continuous bus ratings shall be as shown on drawings. Switchboards shall be legibly marked with the maximum available fault current obtained from the utility company; the marking shall include the date that the fault current calculation was performed.

B. Switchboards shall bear an Arc-Flash Hazard warning label in accordance with CEC Article 110.16.

C. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

D. Enclosure shall be NEMA 250, Type 3R Rainproof.

1. Sections shall be aligned front and rear.
2. Switchboard height shall be 91.5 inches including 1.5-inch floor sills and excluding lifting members and pull boxes.
3. The switchboard shall be of deadfront construction.
4. The switchboard frame shall be of formed steel rigidly bolted together to support all cover plates, bussing and component devices during shipment and installation.
5. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
6. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit.
7. Barriers shall be provided between adjacent switchboard sections.
8. The switchboard enclosure shall be painted on all exterior surfaces in the manufacturer’s standard color, applied over a corrosion-resistant undercoating.

9. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.

10. Top and bottom conduit areas shall be clearly indicated in shop drawings.

E. Utility Pull and/or Metering compartments shall be fabricated to meet the utility company's requirements. If a separate vertical section is required for utility metering, match and align with basic switchboard.

F. Bus Transition and Incoming Line Pull Sections shall be matched and aligned with basic switchboard.

G. Provide 1" H X 3" W engraved laminated nameplates for each device. Furnish black letters on a white background for all voltages.

H. Bus Composition shall be plated copper. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

I. Bus Connections shall be bolted with Grade 5 bolts and conical spring washers.

J. Ground Bus shall be sized per CEC and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.

K. The switchboard shall be accessible from the front, left side and right side.

2.3 MAIN OVERCURRENT PROTECTIVE DEVICE

A. Main Circuit Breaker shall be a fixed mounted, full function, electronic trip molded case circuit breaker.

1. Circuit breaker trip system shall be microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as directed by Engineer.

2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.

4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

a. Long Time Pickup

b. Long Time Delay

c. Short Time Pickup

d. Short Time Delay (I^2t IN and I^2t OUT)

e. Instantaneous Pickup

f. Ground Fault Pickup

g. Ground Fault Delay (I^2t IN and I^2t OUT)

5. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycle short-time withstand ratings. Short-time withstand ratings shall be specified in rms symmetrical amperes, as shown on the drawings.

6. A means to seal the rating plug and trip unit adjustments in accordance with CEC Section 240.6(C) shall be provided.

7. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

8. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with 2% accuracy.

9. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

10. The trip system shall include a Long-Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.

11. Circuit breaker trip systems shall include an externally accessible test port for use with a Universal Equipment Test Set. The test set shall be suitable for testing all electric circuit breakers specified for this project. Circuit breakers shall not require disassembly for testing.

12. Provide one (1) Universal Equipment Test Set for this project job for final inspection.

13. The main circuit breaker shall have an arc energy reduction feature to reduce clearing time. The arc energy reduction feature shall be an energy-reducing maintenance switch with a local status indicator. When the switch is turned on it shall reduce the clearing time and sets the instantaneous pickup clearing time to be 2 times faster than the normal instantaneous pickup sensor amperage.

14. The main circuit breaker shall be rated to allow it to be backfed by a solar photovoltaic or other on-site electrical energy generation system.

2.4 DISTRIBUTION OVERCURRENT PROTECTIVE DEVICES

A. Distribution Circuit Breakers shall be NEMA AB 1, enclosed, Molded-Case Circuit Breakers, with lockable handles.

1. Frame size, trip rating, number of poles, and auxiliary devices shall be as indicated and interrupting capacity rating shall meet available fault current.

2. Overcurrent devices shall be listed for application, including switching lighting loads or heating, air-conditioning and refrigerating equipment.

3. Circuit breakers 400A and larger shall be equipped with trip units interchangeable within frame size.

4. Circuit breakers that are 1200A or larger shall have an arc energy reduction feature to reduce clearing time. The arc energy reduction feature shall be an energy-reducing maintenance switch with a local status indicator. When the switch is turned on it shall reduce the clearing time and sets the instantaneous pickup clearing time to be 2 times faster than the normal instantaneous pickup sensor amperage.

5. Circuit breakers supplying Class 1 transformers shall be lockable in the off position.

6. Mechanical lugs and power-distribution connectors shall be provided for number, size, and material of conductors indicated.

B. Where indicated, equip compartments with mounting brackets, supports, bus connections, and appurtenances designed for future overcurrent protective device of types and ampere ratings indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive switchboard to provide adequate clearance for switchboard installation.

B. Check that concrete pads are level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install switchboard in accordance with manufacturer's written guidelines, the CEC, and local codes.

B. Support switchboards on concrete housekeeping bases, 6-inch nominal thickness.

C. Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

3.3 CONNECTIONS

A. Connect switchboards and components to wiring systems and to ground as indicated and instructed by manufacturer.

B. Tighten electrical connectors and terminals, including screws and bolts, according to manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicates, use those specified in UL 786A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Refer to Specification Section 260800 for minimum required switchboard testing by Contractor and Independent Testing Agency.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values as instructed by the Engineer.

3.6 CLEANING

A. Upon completion of installation, inspect interior and exterior of switchboards. Remove paint spatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 262413

SECTION 262726
WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge suppression units.
4. Wall-box motion sensors.
5. Isolated-ground receptacles.
6. Snap switches and wall-box dimmers.
7. Solid-state fan speed controls.
8. Wall-switch and exterior occupancy sensors.
9. Communications outlets.
10. Pendant cord-connector devices.
11. Cord and plug sets.
12. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

B. Related Sections include the following:
1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with CEC.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Service/Power Poles: One for every 10, but no fewer than one.
   2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.
   3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
   4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 5351 (single), 5352 (duplex).
      b. Hubbell; HBL5351 (single), CR5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 8300 (duplex).
      b. Hubbell; HBL8310 (single), HBL8300H (duplex).
      c. Leviton; 8310 (single), 8300 (duplex).
      d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hubbell; CR 5253IG.
      b. Leviton; 5362-IG.
      c. Pass & Seymour; IG6300.
   2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; TR8300.
      b. Hubbell; HBL8300SG.
      c. Leviton; 8300-SGG.
      d. Pass & Seymour; 63H.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; GF20.
      b. Pass & Seymour; 2084.

2.4 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
   1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
   2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 5362BLS.

b. Hubbell; HBL5362SA.
c. Leviton; 5380.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

C. Isolated-Ground, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper; IG5362BLS.
b. Hubbell; IG5362SA.
c. Leviton; 5380-IG.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper; IG8300HGBLS.
b. Hubbell; IG8362SA.
c. Leviton; 8380-IG.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper Crouse-Hinds.
b. EGS/Appleton Electric.
c. Killark; a division of Hubbell Inc.

2.6 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Hubbell; IG2310.
b. Leviton; 2310-IG.
2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
   1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
   2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
   1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
   2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
      c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
      d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 2221PL for 120 V and 277 V.
      b. Hubbell; HPL1221PL for 120 V and 277 V.
      c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
      d. Pass & Seymour; PS20AC1-PLR for 120 V.
   2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 2221L.
      b. Hubbell; HBL1221L.
      c. Leviton; 1221-2L.
      d. Pass & Seymour; PS20AC1-L.
   2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper; 1995.
    b. Hubbell; HBL1557.
    c. Leviton; 1257.
    d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper; 1995L.
    b. Hubbell; HBL1557L.
    c. Leviton; 1257L.
    d. Pass & Seymour; 1251L.

2.10 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
1. 600 W; dimmers shall require no derating when ganged with other devices.

2.11 FAN SPEED CONTROLS

A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
1. Continuously adjustable slider, 5 A or 1.5 A.
2. Three-speed adjustable slider, 1.5 A.

2.12 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper; 6111 for 120 V, 6117 for 277 V.
    b. Hubbell; WS1277.
    c. Leviton; ODS 10-ID.
    d. Pass & Seymour; WS3000.
    e. Watt Stopper (The); WS-200.
2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

B. Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Hubbell; AT120 for 120 V, AT277 for 277 V.
    b. Leviton; ODS 15-ID.
2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

C. Long-Range Wall-Switch Sensors:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hubbell; ATP1600WRP.
      b. Leviton; ODWWV-IRW.
      c. Pass & Seymour; WA1001.
      d. Watt Stopper (The); CX-100.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft..

D. Long-Range Wall-Switch Sensors:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hubbell; ATD1600WRP.
      b. Leviton; ODW12-MRW.
      c. Watt Stopper (The); DT-200.
   2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft..

E. Wide-Range Wall-Switch Sensors:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hubbell; ATP120HBRP.
      b. Leviton; ODWHB-IRW.
      c. Pass & Seymour; HS1001.
      d. Watt Stopper (The); CX-100-3.
   2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft..

F. Exterior Occupancy Sensors:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Leviton; PS200-10.
      b. Watt Stopper (The); EW-100-120.
   2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.13 COMMUNICATIONS OUTLETS

A. Telephone Outlet:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 3560-6.
      b. Leviton; 40649.
   2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 3562.
      b. Leviton; 40595.
   2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.14 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
   3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.15 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

2.16 POKE-THROUGH ASSEMBLIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
   3. Square D/ Schneider Electric.
   4. Thomas & Betts Corporation.
   5. Wiremold Company (The).

B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
   1. Service Outlet Assembly: [Pedestal type with services indicated] [Flush type with two simplex receptacles and space for two RJ-45 jacks] [Flush type with four simplex receptacles and space for four RJ-45 jacks].
   2. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.
   3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   4. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.
   5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of [two] [four], 4-pair, Category 5e voice and data communication cables.

2.17 MULTIOUTLET ASSEMBLIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Wiremold Company (The).

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: [Metal, with manufacturer's standard finish] [PVC].

D. Wire: No. 12 AWG.

2.18 SERVICE POLES

A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
   1. Poles: Nominal 2.5-inch-square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
   2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
   3. Finishes: Manufacturer's standard painted finish and trim combination.
   4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
   5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
   6. Voice and Data Communication Outlets: Two RJ-45 Category 6 jacks.

2.19 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by CEC or device listing.
   2. Wiring Devices Connected to Emergency Power System: Red.
   3. TVSS Devices: Blue.
   4. Isolated-Ground Receptacles: Orange

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of CEC, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.

2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 265100
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior lighting fixtures with lamps and ballasts.
   2. Emergency lighting units.
   3. Exit signs.
   4. Accessories, including LED fixture dimmers, occupancy sensors and lighting fixture retrofitting.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, and finishes. Clearly identify ballast(s) and lamp(s) for each lighting fixture.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with CEC.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.4 DEFINITIONS

A. PMMA – Poly Methyl Methacrylate

B. CCT – Correlated Color Temperature

C. CRI – Color Rated Index

D. UL – Underwriters Laboratory

E. NRTL – Nationally Recognized Testing Laboratories

F. LED – Light Emitting Diode

G. RoHS – Restriction of Hazardous Substances Directive. H. CSA – Compliance Safety Accountability

H. L70 – Reported Life of LED lumen maintenance (L, in hrs.) 70% lumen maintenance

I. ASTM – American Society for Testing and Materials

J. IBEW – International Brotherhood of Electrical Workers

K. IESNA – Illuminating Engineering Society of North America

L. LM-80 – IESNA approved method of measuring Lumen Depreciation of LED Light Sources

M. LM-79-08 – Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products or LEDs.

N. PFC – Power Factor Correction

O. PCI – Powder Coating Institute

1.5 PERFORMANCE REQUIREMENTS

A. All lighting products as herein after specified shall be a standard product of the manufacturer and shall consist of components that will be readily available for future replacement for period of (3) years.

B. Provide all lighting fixtures as shown complete with all hardware necessary to install fixtures.

C. Luminaire shall be free of light leaks.

D. Luminaire suitable for use in max. ambient temperatures of 35°C (95°F) and minimum ambient operating temperature of -20°C (-4°F) for standard, 0-10V (DM/DML) and Dali dimming driver (DMD). The Minimum ambient operating temperature for the LUTRON driver (DC3/DCE) options is 0°C (32°F).

E. LED package shall be designed around the lumen maintenance of 87% at 60,000 hrs. and is to be expected to achieve L70 at 100,000 hrs.

F. All wiring shall be adequate for LEDs, Driver and Voltage requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 DIRECT LIGHT ENGINE:

A. High efficacy LED light engine equipped with brand-name LEDs available in outputs of 100%, 85%, 70% and 55%.
   1. 1L35 (100%)
   2. 1L30 (85%) Requires Dimming option
   3. 1L25 (70%) Requires Dimming option
   4. 1L20 (55%) Requires Dimming option
      a. All Drivers are Electronic Class 2, high efficiency with the following PFC:
         1) Standard Non-Dimming Driver (PFC>0.95).
         2) Optional 0-10v, & Dali Dimming Drivers (PFC>0.90).

2.3 INDIRECT LIGHT ENGINE:

A. High efficacy LED light engine equipped with brand-name LEDs available in outputs of 100%, 85%, 70% and 55%.
   1. 1L35 (100%)

2. 1L30 (85%) Requires Dimming option
3. 1L25 (70%) Requires Dimming option
4. 1L20 (55%) Requires Dimming option
    a. All Drivers are Electronic Class 2, high efficiency with the following PFC:
        1) Standard Non-Dimming Driver (PFC>0.95).
        2) Optional 0-10v, & Dali Dimming Drivers (PFC>0.90).
        3) Optional Lurton 3-wire and Eco-System Dimming Drivers (PFC 0.99).

2.4 CCT:

A. CCT packages shall be available in 4000K. CCT tolerances are to be kept within a 3-step MacAdam ellipse and are to maintain a Min CRI of 80.
1. 40 (4000K)

2.5 DIRECT SHIELDING:

A. All Shielding's shall be extruded impact resistant PMMA. 1. LW (LED optimized white lens)

2.6 INDIRECT SHIELDING:

A. All Shielding's shall be extruded impact resistant PMMA.
1. LW (LED optimized white lens)

2.7 LAMP BALLASTS

A. Description: Include the following features, unless otherwise indicated:
1. Designed for type and quantity of lamps indicated at full light output except for emergency lamps powered by in-fixture battery-packs.
2. Externally fused with slow-blow type rated between 2.65 and 3.0 times the line current.
3. Warranted for 5 years to include replacement ballasts and labor cost, plus lamp warranty for at least 2 years for lamps used with ballast.

B. LED lamps shall include following features:
1. L.E.D. 4000K - Philips, CREE or approved equal.
2. Comply with NEMA C82.11.
3. Normal Light Output (NLO) BF 0.87.
4. Sound Rating: A.
5. Total harmonic distortion rating of less than 20 percent according to NEMA C82.11.
6. Transient Voltage Protection: IEEE C62.41, Category A.
7. Listed class P automatic reset thermal protection.
8. Lamp Current Crest Factor: Less than 1.7

C. Ballasts for dimmer-controlled fixtures shall comply with general and fixture-related requirements above for electronic ballasts and the following features:
1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming system indicated.

2.8 EXIT SIGNS

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
   1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
   2. Charger: Fully automatic, solid-state type with sealed transfer relay.
   3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.9 EMERGENCY LIGHTING UNITS

A. General: Self-contained units complying with UL 924.
   1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
   2. Charger: Fully automatic, solid-state type with sealed transfer relay.
   3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   4. Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.
   5. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

2.10 EMERGENCY LIGHTING FIXTURES

B. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.
   1. Emergency Connection: Operate one lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
   2. Night Light Connection: Operate one lamp continuously.
   3. Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
   4. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum seven-year nominal life.
   5. Charger: Fully automatic, solid-state, constant-current type.

2.11 LED LAMPS

C. L.E.D. 3500/4000K - Philips, CREE or approved equal.

2.12 FIXTURE SUPPORT COMPONENTS

D. Comply with Division 26 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports, and nonmetallic channel and angle supports.

E. Single-Stem Hangers: 1/2-inch.

F. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

G. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.

H. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

I. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

J. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.13 LIGHTING CONTROL DEVICES

K. Dimming Ballast Controls: Sliding-handle type with on/off control; compatible with ballast and having light output and energy input over the full dimming range.

L. Light Level Sensor: Detect changes in ambient lighting level and provide dimming range of 20 to 100 percent in response to change.
1. Sensor Capacity: At least 40 electronic dimming ballasts.
2. Adjustable Ambient Detection Range: 10 to 100 fc minimum

M. Occupancy Sensors: Adjustable sensitivity and off delay time range of 5 to 15 minutes.
1. Device Color:
a. Wall Mounted: White.
b. Ceiling Mounted: White.
2. Occupancy detection indicator.
3. Ultrasonic Sensors: Crystal controlled with circuitry that causes no detection interference between adjacent sensors.
4. Infrared Sensors: With daylight filter and lens to afford coverage applicable to space to be controlled.
5. Combination Sensors: Ultrasonic and infrared sensors combined.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least two independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging. Pendant fixtures shall be free to swing a minimum of 45 degrees from the vertical in all directions without contacting any obstructions. Otherwise, seismic restraints are required.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Continuous Rows: Suspend from cable.

D. Air-Handling Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable fixtures to provide required light intensities.

F. Occupancy sensor and daylighting sensor placement review by factory representative is required before installing sensors.

3.02 COMMISSIONING

A. All electrical power and lighting controls will be commissioned per the requirements of Section 01810, Commissioning Requirements. Contractor is to provide a factory representative to start-up, test, and commission all lighting controls.

END OF SECTION

SECTION 265600
EXTERIOR LIGHTING

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 shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SCOPE

A. The Contractor shall provide, install, connect, commission, test and place into operation a complete lighting system in accordance with the requirements of 2022 California Energy Code, California Code of Regulations Title 24, Part 6, and as herein specified.

B. Basis of Design for lighting system: Lighting systems are primarily based on the use of dimmable LED fixtures as specified herein.

C. Provide lighting fixtures of sizes, types and ratings as indicated by Drawings and Schedules, including, but not limited to, housing, light emitting diode (LED) modules, LED drivers, lamps, lamp holders, ballasts, reflectors, diffusers, emergency lighting units, starters, wiring, accessories, poles, pole bases and mounting hardware.

1.3 DEFINITIONS

A. A Fixture is a complete unit, exit sign, or emergency lighting unit. Fixtures include LED modules or lamps, as specified, and parts required to distribute light, position and protect LED modules or lamps, and connect and disconnect LED modules or lamps to and from the power supply.

B. An Emergency Lighting Unit is a fixture with integral emergency battery-powered supply and the means for controlling and charging the battery. It is also known as an emergency light set. Emergency lighting units include ones with and without integral LED or lamp heads.

1.4 DESIGNATION

A. Unless otherwise shown on the plans, fixture type designation for an individual fixture shall be typical for similarly indicated fixtures within the entire room or defined area.

B. Unless otherwise shown on the plans, fixtures mounted in a continuous row shall be of the same type as any individually designated fixture within the row.

C. Where a fixture is undesignated on the plans, it shall be of the same type as fixtures of similar function within the room it is located or within similar rooms or areas.

1.5 COORDINATION

A. Confirm compatibility and interface of other materials with luminaires and structural system. Report discrepancies to the Architect or Electrical Engineer, and defer ordering until clarified.

B. Supply plaster frames, trim rings, and back boxes to other trades.

C. Coordinate with Division 21-25 to avoid conflicts between luminaries, supports, fittings, and mechanical equipment.

1.6 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Product Data

1. Submit complete list of fixtures and manufacturer's catalog cuts and installation instructions on each type of lighting fixture and component. Include data on lamps, ballasts, poles, accessories, and finishes. Include details indicating compatibility with ceiling grid system.

2. Submit outline drawings indicating dimensions and principal features of fixtures and poles.

3. Submit manufacturer's data on lighting control equipment and components. Include complete wiring diagrams, with wiring types and any installation limitations.

4. Submit battery and charger data for emergency lighting units.

C. Shop Drawings

1. Submit layout drawings of all non-standard or customized fixtures. Drawings shall include mounting and feed points and methods.

2. Submit wiring diagrams detailing wiring for control system specific to this Project and showing both factory-installed and field-installed wiring, and differentiating between factory-installed and field-installed wiring.

D. Operation and Maintenance Data

1. Submit operation and maintenance data for lighting control devices to include in maintenance manuals specified in Division 01 and Specification Section 260100.

1.7 QUALITY ASSURANCE

A. Nothing in these Drawings or Specifications shall be interpreted as to permit any device, system, or work that is not in compliance with the current California Code of Regulations. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Applicable codes and regulations include, but are not limited to, the following:

1. Fixtures and emergency lighting units shall be certified by the manufacturer as meeting efficiency requirements prescribed under the test methods of the current California Code of Regulations Title 20, Appliance Efficiency Regulations.

2. All work, commissioning and testing shall fully comply with the 2022 California Energy Code.

1.8 WARRANTY

A. The Special Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty for Batteries

1. Submit a written warranty executed by the manufacturer agreeing to replace (includes material and labor) rechargeable system batteries that fail in materials or workmanship within the specified warranty period.

2. The Special Warranty Period shall be manufacturer's standard but not less than 10 years after date of Completion. Full warranty shall apply for first year, and prorated warranty for last 9 years.

C. Special Warranty for Exterior Fixtures

1. Submit a written warranty signed by manufacturer and installer agreeing to replace external parts of lighting fixtures exhibiting a failure of finish within specified warranty period.

2. Failure of finish is defined as perforation or erosion of finish due to weathering or fading, staining, and chalking of finish color due to effects of weather and solar radiation.

3. The Special Warranty Period shall be five years from date of Substantial Completion.

D. Special Warranty for LED Modules and Drivers

1. LED modules and drivers shall be provided with a five year warranty including labor charges for replacement of defective LED modules and drivers.

PART 2 - PRODUCTS

2.1 FIXTURES (General)

A. The fixtures described in the Lighting Fixture Schedule on the drawings are to be used as a standard of quality to be maintained. Substitute items of same function, performance, and appearance are acceptable in conformance with Section 26 01 00, except where noted otherwise.

B. Provide fixtures complete with all fittings, LED modules, drivers, lamps, ballasts, stems, hangers, and component parts to make a complete installation. Fixtures shall have a suitable interior means of grounding the enclosure.

C. All attaching devices for recessed or surface mounted fixtures mounted in the ceiling shall be of formed or rolled steel and of sufficient strength to prevent movement of fixture after installation.

D. The Architect, Electrical Engineer or Owner shall have the right to reject any damaged fixture, including any fixture with damaged or cracked finishes, broken or bent metal, damaged or broken lenses. Any fixture with an appearance deemed to be abnormal, may also be rejected by the Architect, Electrical Engineer or Owner. Rejected fixtures shall be removed and replaced with an undamaged fixture at no cost to the Owner.

E. There shall be no visible trademarks or monograms on the lighting fixtures.

F. Doors, frames, and other internal access shall be smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during maintenance and when secured in operating position.

G. Minimum reflectance of reflecting surfaces shall be as follows, except as otherwise indicated:

1. White Surfaces - 85 percent.

2. Specular Surfaces - 83 percent

3. Diffusing Specular Surfaces - 75 percent

4. Laminating Silver Metallized Film - 90 percent

H. Fixtures installed in non-hazardous locations shall conform to UL 1598.

I. Light emitting diode (LED) equipment used in fixtures shall conform to UL 8750.

J. Exposed hardware shall be stainless steel.

2.2 LED FIXTURES

A. LED Modules

1. Color Temperature: 4,000 Kelvin (K)

2. Color Rendering: 70 CRI, or greater

3. Light Distribution: As indicated on Lighting Fixture Schedule

4. Rated Life: 60,000-hours, with 90-percent lumen maintenance at 50-degrees C, in accordance with TM-21-11.

B. LED Drivers

1. LED Drivers shall be independently tested by Intertek and shall bear the ETL Listed Mark as proof of meeting the applicable published safety standards.

2. LED Drivers shall be independently tested and certified by Underwriters Laboratories (UL) to meet FCC Regulations Part 15 and Part 18 and NEMA standards regarding electromagnetic and radio frequency interference, shall bear the United States UL Listed Mark as proof of meeting the applicable published standards.

3. LED Drivers shall comply with ANSI C62.41, Category A and IEEE 587 standards regarding harmonic distortion and surge protection. Total Harmonic Distortion (THD) shall not exceed 20 percent.

4. LED Drivers shall comply with IEC standard 60929, Annex E and shall source no more than 2mA of control current at 0-10VDC.

5. LED Drivers shall be solid-state, electronic, high power factor (minimum 0.9).

6. LED Drivers shall have a Class A sound rating.

7. LED Drivers shall have internal thermal protection to limit driver case temperature to a maximum of 75-degrees C.

8. Ambient Operating Temperature Range: -40-degrees C to 55-degrees C.

9. Rated Frequency: 60-Hertz

10. Rated Life: 60,000-hours

C. Quality Control

1. Testing and measurement of LED lighting fixture performance shall comply with IES LM-79-08 and IES LM-82-12.

2. Testing and measurement of LED and LED module lumen maintenance shall comply with IES LM-80-08.

2.3 EXTERIOR FIXTURES

A. Metal parts of exterior fixtures exposed to weather conditions shall be constructed of cast or spun aluminum, cast bronze, stainless steel or other nonferrous metals available to withstand exposure.

B. Steel fixtures installed in damp or wet locations shall have zinc-chromate or equal primer.

C. Provide gaskets on all trims and housings.

D. All exterior fixtures shall be supplied by a branch circuit that is controlled by an astronomic time clock that is programmed to automatically turn lights off during daylight hours.

2.4 POLES

A. Light standards shall be as specified on the Lighting Fixture Schedule. Where a color is specified a powder coating and over galvanizing finish shall be applied.

B. Poles shall have provisions for bonding to ground and shall be bonded to the equipment grounding conductor run with the supply branch circuit.

2.5 WET AND DAMP LOCATIONS

A. All lighting fixtures installed in damp locations shall have UL approved “wet” or “damp” location labels visible in interior of fixtures.

B. All lighting fixtures installed in wet locations shall have UL approved “wet” location labels visible in interior of fixtures.

PART 3 - EXECUTION

3.1 LIGHTING FIXTURES INSTALLATION

A. All new fixtures shall be securely anchored to prevent any possible chance of their falling.

B. Install equipment level and plumb and according to manufacturer’s written instructions.

C. Fixture installation shall conform to all applicable standards for installation, mounting, wiring, and quality.

D. All fixtures shall be grounded and bonded in accordance with applicable codes.

E. All fixtures, lenses, and other trim shall be aligned, cleaned, free of paint and blemishes before final acceptance.

3.2 FIELD QUALITY CONTROL

A. Refer to Specification Section 260800, Commissioning of Electrical Systems, for minimum required lighting testing by Contractor.

3.3 CALIFORNIA ENERGY CODE COMPLIANCE DOCUMENTATION

A. The Contractor shall prepare and submit the following Certificates of Installation:

1. Outdoor Lighting:

a. Certificate of Installation – Outdoor Lighting (NRCI-LTO-01-E)

b. Certificate of Installation – EMCS – Lighting Control System (NRCI-LTO-02-E)

B. The Contractor shall provide the services of a California state certified lighting controls acceptance test technician (CLCATT) to perform acceptance tests, prepare Certificates of Acceptance and certify that all indoor and outdoor lighting systems comply with the 2022 California Energy Code Section 130.4. The Certificates of Acceptance shall bear the name and certification identification number of the certified lighting compliance acceptance test technician. The certified lighting compliance acceptance test technician shall prepare and submit the following Certificates of Acceptance:

1. Outdoor Lighting:

a. Certificate of Acceptance – Outdoor Motion Sensor and Lighting Shut-off Controls (NRCA-LTO-02-A)

C. The Contractor shall properly calibrate all lighting control devices and systems. To verify that the lighting control devices and systems have been properly calibrated the Contractor shall conduct the following tests as outlined in Chapter 13 of the 2022 California Energy Commission Nonresidential Compliance Manual, Article 13.87 Test Procedures for Indoor & Outdoor Lighting, and make modifications to the control until it passes the test:

1. Outdoor Lighting

a. 13.92 (NA7.8) Outdoor Lighting Shut-off Controls

END OF SECTION 265600

SECTION 271000
TELECOMMUNICATIONS INFRASTRUCTURE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Materials, labor, equipment, testing, and documentation for a complete local area network (LAN) structured cabling system in accordance with the following published standards, hereinafter referred to as the “Standards”:

B. ANSI/TIA/EIA 568A “Commercial Building Telecommunications Cabling Standard”.

1. ANSI/TIA/EIA 569 “Commercial Building Standard for Telecommunications Pathways and Spaces”.

2. EIA/TIA TSB-67 “Transmission Performance Specifications for Field Testing of UTP Cabling Systems”.

3. ANSI/TIA/EIA 606 “Administration Standard for the Telecommunications Infrastructure of Commercial Buildings”.

4. TIA/EIA 607 “Commercial Building Grounding and Bonding Requirements for Telecommunications”.

5. ANSI/TIA/EIA-A-5.

6. EIA/TIA TSB-95.

7. TIA/EIA 568 - Commercial Building Telecommunication Cabling Standard.

C. The scope of the LAN infrastructure includes the following:

1. Provisioning of telecommunications equipment rooms and closets including:

a. Main distribution facilities (MDF).

b. Intermediate distribution facilities (IDF).

2. Pathways including conduits, junction boxes, cable trays, ducts, wire-ways, cable supports, and cabling management systems.

3. Freestanding floor and/or wall mounted equipment racks.

4. Backbone cabling.

5. Horizontal cabling.

6. Telecommunication outlets and data jacks.

7. Cross-connect fields, interconnect / patching equipment, patch-panels, patch cables, wiring blocks and cable terminations at the IDFs/MDFs.

8. Documentation and labeling.

9. Cable testing and reports.

10. Terminal Backboard.

11. Telecommunication Ground Bus Bar.

12. The scope of work under this Section shall include any other work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

1.2 RELATED SECTIONS:

A. Section 260500:Common Work Results for Electrical

B. Section 260519: 600-Volt Power Conductors and Cables

C. Section 260526: Grounding and Bonding

D. Section 260533: Raceway and Boxes for Electrical Systems

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in installing products specified in this section with minimum three years' experience.

C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years' experience.

D. The owner reserves the right to require the Contractor to remove from the project any such employee the Owner deems to be incompetent, careless or insubordinate.

E. All clean up activity related to work performed will be the responsibility of the Low Voltage Contractor and must be completed daily before leaving the site.

1.4 WORK NOT INCLUDED

A. Hubs, switches, routers, transceivers, and other active network equipment.

B. Servers and workstation equipment.

1.5 SUBMITTALS

A. Backbone and horizontal cabling including but not limited to the following:

1. Fiber-optic (FO) cables.

2. Unshielded twisted pair (UTP) cables.

B. Connectors, splices, and terminations used for FO and UTP cabling.

C. Distribution equipment racks, frames, bracing, and anchors.

D. Surface raceway, cable tray, and cable management systems.

E. Cross-connect punch-down blocks, UTP modular patch-panels, FO management panels, and components.

F. Telecommunication outlet jacks, boxes, bezels, modules, and cover-plates.

1.6 COORDINATION

A. Coordinate with building management on all new telecommunication connections. Verify exact location and existing products used.

PART 2 - MATERIALS

2.1 RACEWAYS, PATHWAYS, AND BOXES

A. Provide conduit, wireway, cable-trays, junction boxes, and outlet boxes as indicated on the Drawings. Materials shall be in accordance with Specification Section 260500 in addition to specific requirements of the Standards.

B. Provide pull-lines in both empty and partially occupied data and telecomm raceways. Partially occupied raceways are considered to be those that are filled to less than 40 percent of the cross sectional area of the raceway. Pull-line sizes and types are as follows:

1. Conduits 1¼" and smaller: 3/16" polyester pre-measured printed tape, Greenlee Textron #434 or approved equal.

2. Conduits 1½" and larger: 1/4" Kevlar pre-measured printed tape, Greenlee Textron #39243 or approved equal.

3. Cable trays longer than ten feet in length: Rig continuous traveling pull-lines of 1/4" polypropylene between access points so as to allow multiple sequential cable installations over the life of the Project.

C. Provide rough-in outlet boxes for data and telecomm outlets in size 4-11/16" square by 2-1/8" deep with single gang plaster rings. Select special knockout provisions to match the conduit entries indicated on the Drawings.

2.2 TERMINAL BACKBOARDS

A. 3/4" exterior grade plywood, finished on one side. Furnish in 4' x 8' sheets and cut to fit the available space. Finish with two coats of white fire retardant paint. Leave one label unpainted.

2.3 EQUIPMENT RACKS

A. MDF/IDF: Standard EIA 19", floor mounted, 2-post, 72" high. Chatsworth or equal. Provide mounting brace for anchorage to the wall and/or floor. Provide mounting brackets, fan and power strip. Provide shelving as necessary to accommodate equipment installed.

B. Enclosed MDF/IDF: Enclosed standard EIA 19", floor mounted, 72" high. Cooper B-Line V-line frames V4229 or equal. Provide mounting brace for anchorage to the wall and/or floor. Provide mounting brackets, fan and power strip. Provide High flow vented doors and walls with locks. Provide shelving as necessary to accommodate equipment installed.

C. Enclosed Wall mounted IDF cabinet: 19” EIA, wall mount cabinet. Chatsworth M-Series Mega Frame #M152 with perforated metal front and rear doors or approved equal. Provide power strip or equal. Provide blocking and mounting brace for anchorage to the wall. Provide mounting brackets, fan and power strip. Provide shelving as necessary to accommodate equipment installed.

2.4 CABLE TRAY AND RACK SYSTEMS

A. Ceiling mounted 18-inch fiber rated rack for cable management. Copper, B-line “Flextray”. Length as shown.

B. Wall mounted half-rack where shown on drawings and for cable management in IT room: Extruded aluminum construction, 3” loading depth, 9” rungs on 6” spacing, flush mounted without spacers or brackets, B-Line “HALF-RACK” #C3A1H06-09-length as shown. Provide #B594 clevis U-brackets at 32” Maximum on center.

2.5 PATCH PANELS AND CROSS-CONNECTS

A. All UTP components shall be rated to CAT-6A including cable, outlets, terminations, and patch panels.

B. Fiber optic (FO) components:

1. Fiber Optic termination panels, wall mounted: Panduit #FWME2 or equal.

2. Fiber Optic interconnect drawer, rack mounted: Panduit #FMD2 or equal.

3. Fiber Optic adapter panel for duplex SC connectors: Panduit #FAP3WDSC or equal. (Two required per twelve fiber cable).

4. Blank Adapter panels: Panduit #FAPB or equal.

C. Unshielded twisted pair (UTP) components:

1. Cat 6A UTP termination panels, 48 port, rack-mounted: Panduit #CPP48WBLY or equal.

2. Cat 6A UTP termination modules, T568B (RJ45 type): Panduit #CJS6X88TG-X (color per scheme) or equal.

D. Inter-Connect patch Cords: Four twisted-pair stranded, Category 6A Enhanced Power Sum, 24 AWG copper conductors. Individual conductors PVC jacketed. Connector plug shall be polarized to prevent polarity reversal or split pairs, and shall be factory-marked to indicate top of connector. Inter-connect cord shall be UL listed.

1. The Contractor shall complete data interconnects between patch panels and Owner-provided active network electronics.

2. Minimum performance specifications:

a. The data equipment inter-connect cable must meet the impedance, attenuation and NEXT requirements for Category 6A Horizontal Cable of EIA / TIA 568 B.

E. Cross-Connect Wire: One and Two twisted pair, 24 AWG solid copper conductors. Individual conductors PVC jacketed. One pair shall be yellow/blue color code and 2

twisted pairs shall be red/blue and red/orange coded. Must be UL listed for use as cross-connect wire. Provide one 500-foot reel of each type for use by Owner.

1. Contractor to assist Owner to perform all voice cross-connects.

2. Minimum performance specifications:

a. Cross-connect wire used on “voice” (telephone) cross-connects must meet the EIA/TIA 568 B impedance, attenuation and NEXT requirements for Category 3 horizontal cable.

F. Cable management components:.

1. Vertical cable management, 4”x5” plastic wiring duct, front and rear: Cooper B-line #SB860 (on sides of racks) or equal.

2. Horizontal cable management, 3”x3” plastic wiring duct on front, 2”x4” plastic wiring duct on rear, 2 rack space unit: Cooper B-line #SB870 (required between patch panels and at top and bottom) or equal.

3. Cable ties: Velcro type, Panduit HLT or HLS series or equal.

G. Termination Hardware at IDF’s (Voice only) See drawings for locations.

1. All cables installed for voice application shall be terminated in accordance with industry standards on 110S type wiring blocks.

2. Avaya 110A type wiring blocks with metal backboard category 6 insulation displacement style, or equal shall be installed with sufficient spacing to permit the orderly routing of jumper cables between wiring blocks, and wire management accessories shall be provided for each 110 block.

3. UTP cable terminating blocks: Compact 110-type or equal Category 6 insulation displacement terminal blocks complete with mounting hardware, connecting blocks, retainers, wire guides, designation strips, etc, UL listed.

a. Minimum performance specifications: Must meet EIA/TIA 568-A Section 10 requirements for Category 6A.

2.6 FIBER OPTIC (FO) CABLE

A. Indoor Fiber Optic backbone cable: 6-strand, 62.5/125 mm, multi-mode, riser type, NEC rated OFNR/FT4, color coded, ripcord, 900 mm buffer coating, Siecor MIC #006K81-31141-00 or equal.

B. Outside Plant Fiber Optic backbone cable: 6-strand, 62.5/125 mm, multi-mode, riser type, black jacket, ripcord, Berk-Tek #OPD006GB3510/25 or equal.

C. Buffer Tube Fan-Out Assemblies: Siecor BTF or equal.

D. Other Fiber Optic cable: As indicated on the Drawings.

2.7 UNSHIELDED TWISTED PAIR (UTP) CABLE

A. Category 6A UTP cable: Unshielded, 4 twisted-pair, 24 AWG copper, Category 6A, NEC Article 800 type CMR rated, non-plenum type, tested to 550MHz, Superior Essex DataGain Category 6, #6H-246-xA, or equal, color per established scheme or at owners IT representatives directive.

B. Category 6A UTP cable: Unshielded, 4 twisted-pair, 24 AWG copper, Category 6A, NEC Article 800 type CMP rated, plenum type, tested to 550MHz, Superior Essex DataGain Category 6, #6H-246-xB, or equal, color per established scheme or at owners IT representatives directive.

C. Other UTP cable: As indicated on the Drawings.

2.8 CATV CABLE

A. Provide RJ6 for branch runs under 100ft.

B. Provide RJ11 for branch runs longer than 100ft.

2.9 TELECOMMUNICATIONS OUTLETS & DATA JACKS

A. Where individual wall data outlets are indicated, provide 4-port, single-gang outlets with bezels, adapters, faceplates, and Category 6, RJ45 modules. The actual quantity and configuration of activations shall be as scheduled on the Drawings.

1. Faceplate bezel: Panduit #CBEIW or equal.

2. Sloped inserts: Panduit #CHS2IW-X or equal.

3. Blank inserts: Panduit #CHB2IW-X or equal.

4. Modular jacks, T568B (RJ45 type): Panduit # CJS6X88TG-X or equal (color per scheme).

B. Where data outlets in modular furniture are indicated provide surface mounted boxes for outlets, and Category 6A, RJ45 modules. The actual quantity and configuration of activations shall be as scheduled on the Drawings.

1. Boxes shall be Panduit CBXC4X-A or equal.

2. Modular jacks, T568B (RJ45 type): Panduit # CJS6X88TG-X or equal (color per scheme).

C. Where data outlets in Wiremold 5400 surface raceway are indicated, provide 4-port, single-gang outlets with brackets, adapters, faceplates, and Category 6A, RJ45 modules. The actual quantity and configuration of activations shall be as scheduled on the Drawings.

1. “Decora” style frame for twin style wireway covers: Panduit #CFG4IW or equal.

2. Modular jacks, T568B (RJ45 type): Panduit # CJS6X88TG-X or equal (color per scheme).

3. Provide matching, coordinated, Wiremold faceplate.

D. Provide surface mounted boxes for outlets installed using surface mounted conduit or wireway. Size the box for the largest required conduit or wireway entry. Provide single gang outlet with accessories and faceplates to match in appearance to flush mounted telecommunication outlets.

E. Single data outlets that must be concealed in under-floor duct or attached inconspicuously to furniture or casework shall be fastened with low profile, two module, surface mount boxes. In no case shall cable data or telecom cabling be directly terminated without physical protection and support.

1. Outlets box: Panduit #CBXJ2IW-A or equal.

2. Modular jacks, T568B (RJ45 type): Panduit # CJS6X88TG-X or equal (color per scheme).

F. Verify the color selection of data and telecommunications devices in the finished environment with the government's representative prior to installation.

PART 3 - EXECUTION

3.1 CABLE AND WIRE INSTALLATION

A. This contractor shall be responsible for the provision and installation of all data and voice cables including all supports, hangers, and hardware necessary for a complete installation. Under no circumstances shall cables be laid on the suspended ceiling or on floors when installed under raised floors. This contractor shall be responsible for providing and installing all necessary cable support hardware to meet Category 6A requirements.

B. At each voice/data closet cables are to be segregated by type, neatly tied together and routed to the patch panels and 110 blocks. All cables shall be tagged.

C. Cable distances from patch panels to data outlet shall not exceed 295 feet. This contractor is responsible to ensure the distance specified is not exceeded.

D. Care shall be exercised in routing both station and backbone/tie cables so as to avoid areas where sources of high levels of EMI (such as electric motors, transformers and fluorescent lighting fixtures) may exist. Maintain a minimum distance of 12 inches from these sources when run parallel. Cross at 90-degree angles where crossing must occur.

E. Each station cable shall be "home run" (no splices or cross connection points) between jacks and patch panels.

F. All openings or raceway transitions through firewalls and floors shall utilize UL listed fire-rated penetrations.

G. Allow slack in Category 6A Cable bundles at entrances and exits of conduit sleeves and at transitions from "J" hooks to cable trays. Never pull cables tight at cable tray transitions; doing so may damage the cables by crimping them on the cable tray side of the bundles.

H. Keep the cable evenly distributed within the cable tray. Do not allow the cables or bundles to be pulled tight against the splines or to be unevenly balanced on one side of the tray.

3.2 RACEWAYS, PATHWAYS, AND BOXES

A. Install conduit, wireway, j-hooks, cable-trays, junction boxes, and outlet boxes as indicated on the Drawings. Installation methods shall be in accordance with Section 260533: Raceway and Boxes for Electrical Systems in addition to the specific requirements of the Standards.

B. FIRE AND SMOKE PARTITION PENETRATIONS

1. Conduit sleeves shall be provided as part of this contract as a means of routing cables through fire-rated walls and floors. Openings in sleeves and conduits used for system cables and those that remain (empty) spare shall be sealed with an approved fireproof, removable sagging material at completion. Sleeves, which pass vertically from floor to floor, shall be sealed in a similar manner using an approved re-enterable system. Additional penetrations through rated assemblies, necessary for passage of

voice/data wiring, shall be made using an approved method and permanently sealed after installation of cables.

3.3 TERMINATIONS AND SPLICES

A. Perform terminations and splices of backbone and horizontal cabling at each the IDF and station outlets. Splices and terminations shall be performed only by competent technicians proficient in latest standardized procedures.

B. Fiber Optic splices shall be performed by means of the thermal fusion splicing method. Maximum allowable average splice loss shall be 0.05 dB. Maximum allowable absolute splice loss shall be 0.15 dB. Maximum allowable reflectance shall be –65dB.

C. Fiber Optic terminations shall be performed by means of the UV-cure, Epoxy and Polish, or other comparable methods. Maximum allowable average insertion loss shall be 0.15 dB. Maximum allowable absolute splice loss shall be 0.30 dB. Maximum allowable reflection shall be –55 dB.

D. Category 6A UTP cabling terminations shall be performed using the insulation displacement contact (IDC) method. Take special care to observe jacket cut-back and pair twist requirements to preserve the performance of data cabling.

E. Route, lace, and support both FO and UTP cabling in accordance with the Standards. Observe published bending radius and pulling tension limitations during installation.

F. The entire UTP channel shall be installed, terminated, and tested to meet or exceed CAT-6A standards.

G. Provide a minimum of 7’ slack for UTP cable at each MDF/IDF, 10’ slack at ceiling panels, and 1’ slack at data outlets to allow for adds/moves/changes.

H. Provide a service loop for FO cable at each MDF/IDF consisting of a minimum of 15’ of cable at or above the ceiling in the vicinity of the termination rack. In addition, at the FO termination tray, provide a minimum of 36” extra strip length for the buffer tube & fan-out assembly to allow each termination to be removed from the tray for inspection and assembly without disturbing adjacent terminations.

3.4 TERMINAL BACKBOARDS AND EQUIPMENT RACKS

A. Fasten backboards securely to the structural wall framing. Provide blocking between wall studs or metal framing prior to application of wall finishes where substantial support cannot be obtained for the wall framing alone. Install the board with the finished side out and secure with #12 x 3” all-purpose screws spaced at not more than two feet apart.

B. Anchor freestanding equipment racks to the building floor with 3/8” x 3” lag screws or concrete expansion wedge anchors fastened through the base plate. Provide a minimum of four (4) anchors per rack. In addition racks over 47” high shall be tied back to the building structure at the top using a brace for additional seismic support.

3.5 TELECOMMUNICATIONS OUTLETS & DATA JACKS

A. Provide flush, large, double gang, back-boxes with single gang plaster rings for mounting of telecommunications outlets in finished walls.

B. Where station outlets are indicated with voice and data services combined, use a different color jack for each service. The jack color assignments shall be consistent throughout the entire Project.

C. Unless otherwise indicated, wire Category 6A, UTP data jacks to the TIA 568B wiring configuration.

D. Surface mounted devices shall only be used if shown on drawings or directed by Superintendent.

E. Each outlet location shall be identified with a distinct callout and identified on each cable.

3.6 LABELING: LABELING SHALL INCLUDE, BUT NOT BE LIMITED TO:

A. Labeling telecommunications outlet faceplates;

B. Labeling station cables;

C. Labeling terminal blocks;

D. Labeling fiber optic cable sheaths:

E. Labeling of all grounding conductors and ground bars in the Intermediated Distribution Facilities (IDFs) and Main Distribution Facility (MDF).

F. Station Cables/FO:

1. All labels shall be polyester with white color.
2. Station Cables: All labels shall be at least 1.00- inches in width and 1.33-inch in length; with a 0.5-inch x 1-inch printable area;
3. Fo Cables: All labels shall be at least 1.87- inches in width and 3.167-inch in length; with a 0.5-inch x 1-inch printable area.
4. Labels shall have an adhesive backing.
5. Labels shall be attaché to cable sheaths by wrapping around the sheath with the adhesive back self-laminating portion.
6. Labels shall be laser printed with the labeling scheme as specified.

G. Cable / outlet / jack / termination identification:

1. Each copper cable, its associated 568A jack at the outlet, and the associated C-4 connecting block on the terminal block or patch panel shall be labeled with a unique identifier consisting of the following:
    a. The IDF room number where the station cable is terminated, ###.
    b. The end user room number in which the 4-pair cable is terminated and the telecommunications outlet is located, ###.
    c. A 3-digit serial number, rest to 001 for each room, which sequentially identifies each telecommunications jack / cable in a room, ###.
    d. The type of service provided by a Particular cable, either D for data or V for voice.
2. Example of IDF 107, user room 129, jack /cable number 1: 107-129-001-D.

3.7 TESTING AND DOCUMENTATION

A. Fiber Optic (FO) cable: Conduct performance testing of fiber optic cable in accordance with EIA/TIA standardized procedures. Use Optical Time Domain Reflectometer (OTDR) and Optical Loss Test Sets (OLTS) that have been calibrated against National Institute of Standards & Technology (NIST) standards during the previous twelve months. Operate and adjust the test equipment in accordance with the manufacturer's directions. The test set operating instructions, as published by the manufacturer, shall be made available for inspection by the Project Inspector or Engineer at the time of the test.

B. Testing for Fiber Optic (FO) cable shall be in accordance with ANSI/TIA/EIA-526-7 and ANSI/TIA/EIA-526-14 and TSB-72

C. Fiber Optic cable shall meet the performance criteria as stipulated in the table below and as amended by the latest applicable Standards. Replace, re-splice, or re-terminate cables that do not meet the specified performance criteria. Retest and document the replacement cables.

D. Tests on FO cables shall be conducted on individual fibers from origination point to termination point; Duplex “Loop-back” testing is not acceptable.

Optical Fiber Transmission Performance Table

WAVELENGTH (NM)	ATTENUATION (DB/KM)	BANDWIDTH (MHZ-KM)
850	3.0	200
1300	0.7	500

E. Retail copies of the Cable Manufacturer’s test results for each reel of FO cable as follows: Provide copies if requested.

1. Bandwidth/Dispersion test data.
2. Index of Refraction.
3. Cable length and reel data.

F. Prepare a type written or hardcopy printout of the report, including OTDR traces, for each cable tested. Provide copies if requested.

G. Testing for UTP cable shall follow TSB-95 and shall include the following: Return Loss, PS-ELFEXT, Far-end crosstalk, Power sum far-end crosstalk, Power sum near-end crosstalk, ACR, Delay, and Delay Skew. Testing shall include both Basic Link and Level II tests. Horizontal UTP cable shall meet the performance criteria as stipulated in the table below and as amended by the latest applicable Standards. Replace, re-splice, or re-terminate cables that do not meet the specified performance criteria. Retest and document the replacement cables.

1. Characteristic impedance: 100 ohms ±15% from 1 MHz to 100 MHz, ±22% from 100 MHz to 200 MHz, ±25% from 200 MHz to 250 MHz, ±32% from 250 MHz to 350 MHz.
2. Minimum ACR: 26dB at 100 MHz and 7dB at 250 MHz.
3. Attenuation is given as the maximum allowable attenuation in dB per 100m for the worst pair in the cable.
4. NEXT (near end cross talk) is given as the minimum allowable NEXT loss in dB for the worst pair in the cable.

H. Horizontal UTP cable connections shall meet the performance criteria as stipulated in the latest applicable Standards. Replace, re-splice, or re-terminate cables that do no meet the specified performance criteria. Retest and document the replacement connectors.

3.8 IDENTIFICATION AND CABLING MANAGEMENT

A. Permanently and clearly identify individual cables, fibers, and grounding conductors at outlets, terminations, and cross connects in accordance with TIA/EIA 606 standards.

B. Clearly identify each cable at IDF and outlet location.

C. Identify at the following locations:

1. Within 12 inches of the point that the cable exits the top or bottom of the 110P-type terminal block column.
2. Within 12 inches of the point that the cable enters a splice.
3. At 40-foot intervals above T-Bar ceilings.
4. At pull boxes
5. Within 12 inches of the point that the cable enters or exits wall and floor sleeves.

D. Cable pair identification:

1. Identify all riser cable pairs in 5-pair increments on a 110 terminal block designation strip. The numbering shall be 4 digits beginning with “0001” and continuing through “0800”. The Contractor shall provide white, laser printer generated designation strips.
2. Identify all riser cable pairs in 5-pair increments on 25-pair connectors. The numbering shall be 4 digits beginning with “0001” and continuing through “0800”.

E. Warning Tags: At each location where fiber cable is exposed, it shall be marked with warning tags. These tags shall be yellow or orange in color, and shall contain the warning: “CAUTION FIBER OPTIC CABLE”. The text shall be permanent, black, block characters, and at least 3/16 high. A warning tag shall be permanently affixed to each exposed cable or bundle of cables, at intervals of not more than (5) feet. Any section of exposed cable, which is less than five (5) feet in length, shall have at least one warning tag affixed to it.

F. Develop a record keeping system for the Project that tracks the location, use, and status of telecommunications and LAN Infrastructure components and equipment.

G. Prepare a report that cross references the linkages between the various components and equipment.

H. Prepare a computer or paper based administration system that documents the above elements. Provide three copies of the system to the government’s representative.

I. For facilities with a functional Telecommunications Administration System in place, prepare the required reports in a compatible format, and coordinate the government’s IT personnel in the preparation and execution of the reports.

3.9 TRAINING AND CROSS CONNECTIONS

A. The Contractor shall provide a minimum of (1) person for a minimum of (8) man-hours beginning with the first scheduled move-in date to train Owner personnel in maintenance and repair of cabling system. This technician shall also assist the Owner in cross connecting the voice and data services throughout the facility during the move-in period. It is at this time that all Owners provided connectivity for voice and data services will be provided to the Contractor. Patching (cross connection) of the station assignments between the Owner’s services demark shall also be considered part of this Contractor’s work.

3.10 RECORD DRAWINGS

A. The project record drawings shall show the types, locations, cable numbers and pair counts of installed twisted-pair cable.

END OF SECTION

SECTION 275103
ASSISTED LISTENING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. All materials, labor, equipment, and incidentals necessary to install an FCC-compliant, ADA-compliant, FM-based, Stationary Assisted Listening System for wireless transmission of sound in the areas noted on the plans and as specified herein.

B. Provide a complete Assisted Listening System (ALS), including transmitter, receiver, headsets, and chargers for the locations indicated on the drawings and/or indicated by the Architect. Equipment for one example system is specified herein.

C. Any associated electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

D. It is the intent of the drawings and specifications that systems be complete and be ready for operation.

E. Provide CBC 2022 compliant seismic installation. See Section 26 05 00 for all certification and submittal requirements.

1.2 SUBMITTALS

A. Comply with the requirements of Section 26 05 00.

B. Provide submittals for the following equipment:
   1. Transmitter
   2. Receivers
   3. Charger
   4. Headsets

C. Equipment Manual: Furnish with the submittal, and with each unit delivered, an equipment manual that details the installation, operation and maintenance instructions for the provided equipment. Provide minimum (3) copies.

D. Spare Parts: Provide a list of customer-replaceable spare parts in the submittal. All spare parts shall be quickly and easily field-replaceable.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. The ALS shall be capable of broadcasting on 57 channels and be frequency agile.

B. The ALS system shall have 80dB SNR or greater, end-to-end. Receivers shall be frequency agile and frequency set with a "seek" button.

C. The receiver shall incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to audio normally.

D. The portable receivers and transmitters shall incorporate automatic battery charging circuitry for recharging of Ni-MH batteries.

2.2 ACCEPTABLE MANUFACTURERS

A. List of Equipment Manufacturers:
   1. Listen Technologies, or equal. All catalog numbers referenced in this specification are by Listen Technologies, unless otherwise noted.

2.3 PRODUCTS

A. Provide (1) transmitter base station with line level audio inputs. The transmitter shall have an easy-to-read front panel display to indicate output levels, channels, and related settings, and shall have push-button controls.
   1. Provide compatible audio cable for interconnection with A/V system.
   2. Catalog number: LT-800-072

B. Provide (1) rack mount kit with plexi-glass security cover.
   1. Catalog number: LA-326

C. Provide (1) universal antenna for mounting on ceiling, wall, remote base, or flexible dipole. If antenna is remoted, provide and install RG58 co-axial cable in 1” conduit for less than 100ft or RG8 co-axial cable in 1” conduit for more than 100ft runs (50 0hm).
   1. Catalog number: LA-122

D. Provide portable FM receiver units equal to 4% of the seating capacity plus (1), minimum of
   (3) units per system.
   1. Each receiver shall have the following characteristics:
      a. Capable of being clipped to a pocket or belt.
      b. Include an on/off switch and volume control to adjust the output level as required by the listener.
      c. Easy-to-read channel label on the front face.
      d. Battery operated.
      e. Designed to allow battery recharging without removal from the receiver. Batteries shall be capable of being recharged with the charger/organizer.
   2. Catalog number: LR-400-072

E. Provide quantity of ear and neckloops equal to the number of receivers provided - 75% ear speakers, 25% neckloops. Neckloops shall be hearing aid compatible.
   1. Catalog number: LA-164 ear speaker.
   2. Catalog number: LA-166 neckloop. Neckloops shall be hearing aid compatible.

F. Provide charger device / storage container(s) to accommodate all of the provided equipment.
   1. Catalog number: LA-321 (8 unit model)

G. Provide Ni-MH rechargeable batteries.

1. Catalog number: LA-362

H. Provide ADA Access/Compliance signage kit and coordinate placement with architect.
1. LA-304

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to Section 26 05 00 for details of work under this section.

B. Assistive-listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.

C. The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of receivers provided, but no fewer than two, shall be hearing-ain compatible in accordnace with CBC Section 11B-706.3.

D. If the systems provided is limited to specific areas or sears, then such areas or seats shall be within a 50-foot viewing distance of, and have a complete view of, the stage or playing area. CBC Section 11B-219.4.

3.2 INSTALLATION

A. Locate transmitter adjacent to an available audio system input.

B. Audio input shall be taken from the audio system (provided in another section of work) via a standard line level stereo audio signal. Connect complete for full operation.

3.3 SYSTEM STARTUP

A. The Manufacturer shall provide a factory authorized technician to commission and confirm proper installation and operation of all system components.

3.4 TRAINING

A. Manufacturer shall provide factory authorized application engineer to train Owner personnel in the operation and programming of the Assisted Listening System. Provide (2) hours on-site training.

3.5 TESTING

A. Test for a complete and operational system after commissioning of ALS System.

B. Test each receiver at each selectable frequency, and at all probable usage locations within the area of intended use.

END OF SECTION

SECTION 283100
FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Existing Silent Knight 6820EVS fire alarm system. Provide new devices required to form a complete coordinated system ready for operation in the new TK building. It shall include, but not be limited to, initiating devices, alarm notification appliances, auxiliary control devices, power supplies, and wiring as shown on the drawings and specified herein.

1.2 SCOPE:

A. This specification outlines the requirements for additions to an existing microprocessor based, addressable (intelligent) automatic fire detection and alarm. The system and components shall be supplied by one manufacturer of established reputation and experience who shall have produced a similar apparatus for a period of at least five (5) years and who shall be able to refer to similar installations in public buildings rendering satisfactory service.

B. The work described in this specification consists of all labor, materials, equipment and services necessary and required to complete and test the automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on drawings but required for proper performance and operation shall be furnished, installed, and connected completely.

1.3 REQUIREMENTS:

A. This installation shall be made in accordance with the drawings, specifications and the following:

1. California Electrical Code (CEC)

2. California Building Code (CBC)

3. NFPA 12 - Standard on Carbon Dioxide Extinguishing Systems.

4. NFPA 13 - Installation of Sprinkler Systems.

5. NFPA 15 - Standard for Water Spray Fixed Systems for Fire Protection.

6. NFPA 16 - Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.

7. NFPA 16A - Standard for the Installation of Closed Head Foam-Water Sprinkler Systems.

8. NFPA 72 - National Fire Alarm Code.

9. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

10. NFPA 101 - Life Safety Code.

11. NFPA 750 - Standard on Water Mist Fire Protection Systems.

12. NFPA 5000 - Building Construction and Safety Code.

13. UL 268 - Standard for Smoke Detectors for Fire Alarm Signaling Systems.

14. UL 864 - Standard for Control Units and Accessories for Fire Alarm Systems.

15. UL 1971 - Standard for Signaling Devices for the Hearing Impaired.

16. UL 2572 - Standard for Control and Communication Units For Mass Notification Systems.

1.4 SYSTEM DESCRIPTION:

A. The system shall be a supervised non-coded 24 volt DC, Power Limited system and capable of having all addressable initiation devices in alarm at one time. Initiation and notification device circuits shall be wired Class B. A single ground or open on any initiating device circuit or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm. The system shall provide for mass notification.

B. Provide initiation, notification and other devices as per specifications and indicated on drawings.

C. Indicate alarms, supervisory and trouble signals on the fire alarm control panel and the remote annunciator located in the Administration Building.

D. Initiate signals to control HVAC system as per local AHJ requirements or as indicated on drawings.

E. Transmit alarm signals to off-site reporting agency via a digital communicator.

F. The fire alarm system shall function as follows when any smoke or duct detector, manual station or other initiating device operates:

1. Operate required audible/visual and visual devices as shown on the Drawings.

2. Automatically notify off-site reporting agency.

3. Indicate at the control panel alphanumeric display the number and location of the alarmed device.

4. Light an indicating lamp on the smoke detector initiating the alarm.

5. Light an indicating lamp on the remote annunciator indicating the location alarmed as well as the type of device alarmed (area smoke detector, duct detector, manual pull station, etc.).

6. Provide additional system features and capacities as indicated in Part 2 of this Section of the Specifications.

1.5 GUARANTY:

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

1.6 SUBMITTALS:

A. Shop Drawings shall indicate the following: building floor plan, location and type of devices, conduit and wire quantities, power requirements, complete wiring point-to-point diagrams, details, and locations of fire alarm and remote annunciator panels.

1.7 APPROVALS:

The control panel and all peripherals shall have proper listing and/or approval from Underwriters Laboratory (UL) and be California State Fire Marshall listed and approved.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model.

B. Acceptable System Manufacturers: See contract drawings.

C. All equipment and components shall be installed in strict compliance with manufacturers' recommendations.

D. All Equipment shall be attached to and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT, BOXES, AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The California Electrical Code (CEC), local and state requirements.

2. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.

3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per CEC Article 760-29.

4. Conduit shall be 3/4 inch minimum.

B. Wire:

1. All fire alarm system wiring shall be new.

2. Wiring shall be in accordance with local, state and national codes (e.g., CEC Article 760). Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 16 AWG for initiating device circuits and signaling line circuits, and 12 AWG for Notification device circuits.

3. All field wiring shall be completely supervised, Class B, with end-of-line devices located as shown on the riser diagram.

C. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their use and purpose.

D. The Fire Alarm Control Panel, Emergency Voice and Communications System Panel, NAC Expander Panels shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the power panel as FIRE ALARM and include a breaker handle lock

for the dedicated breaker. Fire alarm control panel primary power wiring shall be #12 AWG. The control panel cabinet shall be properly grounded.

2.3 INITIATION DEVICES:

A. Addressable Photoelectric Smoke detectors, (Intelligent) shall be provided as indicated on the drawings, with features and characteristics as follows:

1. The detector shall be self compensating for ambient temperature and humidity.

2. The detector shall be addressed, tested and programmed prior to installation using a UL listed programmer/tester. The detector readout shall yield a discrete electrical value for status tracking and logging for determining maintenance and cleaning requirements.

3. The detector shall be suitable for two wire operation and two way communication on the intelligent analog signalling circuits.

4. The detector shall display a flashing red LED when in the alarm state when the system is operating from normal or standby power.

5. The detectors furnished shall be listed for use in environments as covered by Factory Mutual, UL and shall be installed according to the requirements of CEC for open area coverage.

6. Detectors for magnetic door hold open functions shall be provided with an auxiliary relay base for auxiliary function wiring connections.

a. Door holder power shall be routed via the relay base on smoke detectors denoted with an "R" to release the associated doors upon alarm.

B. Heat detectors shall be provided as indicated on drawings. Heat detector shall be of the rate compensation type, 135 degree or high temperature type as shown on the equipment schedule

C. Manual Stations, (Intelligent) shall be single action and semi-flush or surface mounted as indicated on the drawings.

1. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring.

2. The manual stations shall be addressable and identifiable by the master fire alarm control panel when they are resident on the analog loop. Address programming shall be accomplished electronically and reside within the station in non volatile memory.

D. A monitor module Interface device shall be provided for required interface points such as water flow devices and tamper switches, or any contact type devices as indicated on drawings. This Interface device shall have one or two Class B (Style 4) circuits as required.

2.4 BATTERIES

A. Batteries shall be 12 volt, sealed Gell-Cell type, with combined Amp-Hour ratings as required by code.

B. Battery shall have a minimum sufficient capacity to power the fire alarm system for not less than twenty-four hours in standby mode, plus 5 minutes of full system alarm upon a normal AC power failure.

C. The batteries are to be completely maintenance free, no liquids required. Fluid level checks, refilling, spills and leakage shall not be required.

2.5 CONTROL DEVICES:

A. Control modules shall be provided as indicated on the drawings for fire alarm output functions. These devices shall be connected to the Network Communications Lines, and be field programmable for one of the following options; Remote Relay (form C 1amp 24vdc, 200ma 120vac) with supervised relay operation, Remote Supervised Indicating Appliance Circuit (fused at 1 amp). There shall be an LED on the device that will flash to indicate the unit is being monitored and a steady LED to indicate the unit has been activated. Secondary relays with control power connections shall be provided as required where contact ratings (voltage & amps) so dictate.

2.6 NOTIFICATION DEVICES:

A. Speaker/Strobe combinations shall be provided as indicated on drawings. The speaker/strobe combination shall be Wheelock or equal, ADA and UL 1971 compliant (candela values as required).

B. Strobe Lights shall be provided as indicated on drawings. The strobe lights shall be wall mounted at +80" AFF or 6" below the ceiling level, whichever is lower, or ceiling mounted Wheelock or equal, ADA and UL 1971 compliant (candela values as required) - White finish.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the CEC, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. At the final inspection a factory trained representative of the manufacturer of the major equipment shall perform the tests in Section 3.2 TESTS.

E. WIRING:

1. Addressable loops circuits shall be two (2) conductor twisted or wiring approved by the manufacturer. Notification circuits shall be 12 AWG minimum for strobes, but not to exceed manufacturers wire capacity for modules. Control power circuits shall be 14 AWG minimum or as required.

3.2 TESTING:

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
3. Verify activation of all flow switches.
4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open and short all notification appliance circuits and verify that trouble signals actuate.
6. Ground circuits and verify response of trouble signals.
7. Check presence and audibility of tone at all alarm notification devices.
8. Check installation, supervision, and operation.
9. Verify that each initiating device alarm is properly received and processed by the FACP (Walk Test).
10. Conduct tests from the FACP to verify trouble indications for common mode failures, such as alternating current power failure.

B. Test reports shall include, but not be limited to:

1. A complete list of equipment installed indicating proper operations as listed above.

3.3 FINAL INSPECTION:

A. Final acceptance will require the contractor to deliver to the Owner the following;

1. Three (3) copies of the operating instructions and system maintenance manuals.
2. Three (3) set of record drawings.
3. Three (3) copies of the final test reports.
4. Three (3) copies indicating the name and phone number of person to contact in the event of equipment failure, and date when system warranty will be terminate.
5. Three (3) sets of data sheets for each piece of equipment supplied.

B. The fire alarm system subcontractor or manufacturer shall offer for the owners consideration at the time of system submittal a priced inspection, maintenance, testing and repair contract in full compliance with the requirements of CEC.

1. The services offered under this contract shall be performed at no charge during the first year after system acceptance and the owner shall have the option of renewing for single or multiple years, up to five years, at the price quoted in bid.
2. The contractor performing the contract services shall be qualified and listed to maintain ongoing certification of the completed system to the UL for specific installed system listing.

3.4 WARRANTY

A. The fire detection system shall be warranted for a period of one year from date of acceptance. The warranty shall cover parts, labor, and travel to and from the site.

3.5 INSTRUCTION:

Provide complete instruction manuals and training to the building personnel. "Hands-on" demonstrations of the operation of all system components and the entire system shall be provided.

END OF SECTION

SECTION 31 00 00
OFFSITE DEVELOPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

a. Street improvements include, but are not limited to, demolition, clearing and grubbing, pavement removal, relocating or reconstructing interfering existing utilities, setting utility boxes to finished grade, constructing permanent pavement, concrete curb and gutter, concrete sidewalks, accessible ramps valley gutter, pavement striping, and traffic signs all as indicated on the Plans, in these Specifications, and in conformance with the Local Governing Authority's Standard Plans and Specifications.

b. Utility improvements include, but are not limited to, demolition, clearing and grubbing, pavement removal, making new service connections, relocating or reconstructing interfering existing utilities, setting manholes and inlets to finished grade, installing storm drain manholes, pipelines and inlets, and all related appurtenances as indicated on the Plans, in these Specifications, and in conformance with the Local Governing Authority City's or County's Standard Plans, and Specifications and Merced Irrigation District Standard Plans and Specifications.

c. The Contractor is responsible for all coordination and project scheduling with Gas and Electric Companies, Telephone Company, and Cable Television Company regarding their work of relocating and/or under-grounding their facilities within the street right of ways adjacent to the project site and within the project site. Such responsibility shall include, but not necessarily be limited to:

1) The Contractor establishing and maintaining communication with the respective utility companies throughout the project.

B. Where the term "Offsite" is used in the project documentation, it shall be interpreted as work not under the jurisdiction of the Division of the State Architect (DSA). For the purposes of this project, this term shall include all work under the jurisdiction of the City of Merced, and the Merced Irrigation District, even when that work is located within the boundary of the project limits.

C. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

1. ALL DIVISION 00 SPECIFICATION SECTIONS.

2. ALL DIVISION 01 SPECIFICATION SECTIONS.

3. City of Merced standard spedifications and drawings (Not included in the Project Manual but available on the City's website)

4. Merced Irrigation District standard plans and specification (Not included in the Project Manual but available on the District's website)

1.2 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Submittals:

a. Product data submittals shall be compiled into a package as they relate to individual AHJs.

b. Submit product information for all components of construction, including but not limited to, asphalt pavement, aggregate base, concrete mix design, striping paint, reinforced concrete pipe, storm drain manhole materials, storm drain inlets, and traffic signal components.

2. Coordination Drawings:

a. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work of this section. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Civil Engineer.

3. Quality Assurance/Control Submittals:

a. Test Reports:

1) Submit five (5) copies of reports required by Regulatory Requirements.

2) Submit five (5) copies of testing laboratory's report.

4. Closeout Submittals in accordance with Specification Sections in Division 01

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:

   a. CAL/OSHA All work shall comply with the rules and regulations of the California Division of Occupational Safety and Health (formally the Division of Industrial Safety), and all other local, state and federal agencies having jurisdiction. Nothing contained herein shall be construed as permitting work that is contrary to such rules, regulations and codes.

      1) Full compensation for all costs involved in worker protection from caving ground in excavating shall be included in the lump sum price bid for the work under this contract.

   b. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB)and the Environmental Protection Agency (EPA), in the area where the project is located.

   c. CM City of Merced, Standard Drawings and Specifications, latest edition.

   d. MID Merced Irrigation District

   e. In cases of conflicts between the CM standards and specifications for storm drainage work and MID's standards, the MID standards shall govern.

      (a) Surveying and preservation of existing monuments:

         (1) Surveying for offsite improvements shall be secured and paid for by the Contractor. The Contractor shall be responsible to contract for, coordinate and pay for all such services by a Civil Engineer or Land Surveyor registered in California and acceptable to the Architect.

         (2) Carefully preserve all data and monuments set by the Owner's Civil Engineer and, if displaced or lost, the Contractor's Engineer shall immediately replace such monuments to the satisfaction of the CM at no additional cost to the Owner.

   f. Monitoring of construction site:

      1) The Contractor shall monitor the construction site on a regular basis during non-working hours, including weekends and holidays to ensure that no situations arising, relating to the condition of the work site, which could pose a threat to public safety. In addition, the contractor shall furnish to the Owner and to the Local Governing City's Construction Management Division, prior to the issuance of the "Notice to Proceed", a list of persons, together with their addresses and home telephone numbers, who are authorized to act on behalf of

the Contractor in an emergency arising out of conditions at the work site after normal working hours.

2) Safe pedestrian crossings shall be maintained at all existing crosswalks and intersections.

3) The Contractor shall secure the site of work at all times. Children shall not be allowed in or along the excavation, on spoil piles or at other undesirable locations within the work. The Contractor shall provide suitable traffic and pedestrian warning devices and signs necessary at or near the work as required by safety considerations and/or jurisdictional authorities. Convenient pedestrian detours and/or flagmen and/or safe temporary bridges over excavations, complete with adequate safety rails, shall be provided as necessary.

g. Compaction and compaction tests:

1) The Contractor shall be fully responsible for timely compaction and suitability of material for compaction. Where necessary, wet and pumping material shall be removed from the trench or excavation by the Contractor and replaced with suitable approved material as necessary to complete operations within the times allowed.

2) Compaction requirements for all excavations within public streets, shall be in accordance with the CM's Street Work Permit and in accordance with the CM's and MID's Standard Specifications.

3) Initial compaction testing shall be provided by the Owner. The Contractor shall file adequate notice to the project inspector when he desires compaction testing. All required compaction re-testing of backfill because of failure to pass original test shall be at the expense of the Contractor.

4) Full compensation for all costs involved in meeting and satisfying the above requirements shall be included in the amount bid for the various items of work and no separate payment will be made therefore.

1.4 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

3. Before commencing excavation, the Contractor shall notify all utility authorities or utility companies having possible interest in the work of the Contractor's intention to excavate proximate to existing facilities and Contractor shall verify the location of any utilities within the work area.

4. The Civil Engineer has made a diligent attempt to show on the Construction Drawings all pertinent intersecting utilities which may affect the work. Utilities shown in profile view are shown at their most probable locations, based upon available as-built drawings and known construction custom. The Contractor shall exercise caution while performing excavation for this project and shall protect existing utilities from damage, inasmuch as their exact location is unknown until exposed by the excavation.

5. Because of the close proximity of certain existing parallel or intersecting utilities and the depth of the proposed facilities, it may be necessary for the Contractor to provide special protection for the existing utility, and/or provide for its temporary and/or permanent relocation in order to construct the facilities shown on the Plans. Bracing of power poles may be necessary. The Contractor shall coordinate said work and shall be responsible for complying with the requirements of the utility authority involved. Full compensation for all costs involved in such special protection and/or relocation, including all appurtenances and incidentals, shall be included in the amount bid for the various bid items, and no separate payment shall be made therefor.

6. All existing utility mains and service lines shall be kept in constant service during the construction of this project. Hand excavating shall be employed where necessary to safely expose existing utilities.

7. Full compensation for all costs involved in locating, verifying, protecting, exposing, relocating, reconstruction and otherwise providing for utilities shall be included in the amount bid for the various items of work and no separate payment shall be made therefor.

B. Dust Control:

1. The Contractor shall maintain dust control about the site of the work, including any haul roads to or from the site, by whatever means are necessary, such as watering, sweeping or oiling, so as to cause the least possible dust nuisance to the public. Any dust control measure ordered by the owner’s representative shall be promptly and immediately carried out.

2. If the Contractor fails to provide dust control measures so ordered within a period of 2 hours from the time ordered by the owner’s representative, the Contractor

shall pay to the Owner a penalty of Fifteen (15) Dollars for each one half (1/2) hour, or portion thereof, that elapses beyond the 2 hour warning period, until dust control measures ordered by the owner's representative are completely carried out and the dust nuisance eliminated or prevented.

3. Such penalty shall be deducted from any monies owed the Contractor. In addition to the penalty as specified above, if conditions warrant, the Architect may employ other forces to eliminate or prevent the dust nuisance. The full cost thereof, in addition to the penalty as herein provided, shall be deducted from any monies owed the Contractor.

4. Full compensation for dust control shall be included in the amount bid for the various items of work and no separate payment will be made therefore.

C. Traffic Control:

1. Traffic control measures shall be fully and completely carried out at all times to the satisfaction of the CM. If the Contractor fails to provide satisfactory traffic control the Owner may obtain services from other sources and deduct from the contract the cost thereof.

2. Through traffic shall be provided for during non-working hours including, but not limited to, weekends, holidays and at night.

3. The Contractor shall comply with all requirements of the CM's Street Work Permit.

4. Full compensation for traffic control shall be included in the amount bid for the various items of work and no separate payment will be made therefore.

D. Protective measures:

1. Furnish, place, and maintain all supports, shoring, and sheet piling which may be required for the sides of excavation or for protection of adjacent existing improvements. The adequacy of such systems shall be the complete responsibility of the Contractor.

2. Maintain all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

3. Forty-eight (48) hours prior to beginning construction, the Contractor shall notify the owners of all properties adjacent to the proposed construction. The Contractor shall also provide the property owners with an estimate of the length of time that their properties will be affected by his construction activities.

E. Permits:

1. The Owner shall pay for all permits required for work under this contract including, but not limited to, the CM's street work permit, and any other incidental permits. The Contractor shall be responsible for providing any and all required information, such as Certificates of Insurance, Workmen's Compensation forms, etc, to the CM and MID for the issuance of the respective permits. Full compensation for providing said information shall be included in the price bid for the various items of work and no separate payment will be made therefor. Contractor shall comply with all conditions of any permits issued for the project.

2. The Owner shall pay all inspection fees required by governmental agencies.

3. The Contractor shall obtain a permit from the Division of Occupational Safety and Health of the State of California prior to the commencement of construction. Full compensation for said permit shall be included in the price bid for the various items of work and no separate payment will be made therefor.

1.5 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:

2. Warranty Period - One (1) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section -WARRANTIES:

2. Warranty period - One (1) Year.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials incorporated in street and utility construction shall conform with the CM's and MID's Standard Plans and Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.

2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other specification sections to ensure proper and adequate interface of work specified under this specification section.

3.3 CONSTRUCTION

A. Interface with other work:

1. Construction of street and utility facilities shall be performed in accordance with the CM's, and MID's Standard Plans and Specifications.

2. The Contractor shall be responsible to protect all other existing and proposed utilities and improvements affected by his work.

3. The Contractor shall cooperate with all other contractors on the job to insure that his activities do not delay or hinder the construction activities of others.

4. Upon approval, excess earth from trenching and off-site grading may be deposited within the boundaries of the school site at a location specified by the Owner for incorporation in site grading activities. All such earth shall be free of organic material, large rocks, concrete, hardpan, asphalt paving and other deleterious materials.

5. The Contractor shall be aware that the work of this contract is a portion of the total work required for the construction of the project site. The Contractor shall coordinate his work and his schedule fully with other forces performing work relating to the construction of the above stated project. Included in these "other forces" are Gas and Electric, Telephone, the forces constructing on-site and off-site improvements for the above stated project and any other forces performing work within the project area which requires coordination with the work of this contract.

6. The Contractor shall coordinate his efforts with other forces performing on-site work such that said forces are provided with adequate access to the site.

3.4 FIELD QUALITY CONTROL

A. Site Tests:

1. As required by Regulatory Requirements.

B. Inspection:

1. As required by Regulatory Requirements.

2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.

3. No work shall be without the inspections required by Regulatory Requirements.

END OF SECTION

SECTION 31 11 00
SITE CLEARING

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. Provide all material, labor, equipment and services necessary to completely clear and demolish all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. RELATED SECTIONS:

1. Contract General Conditions and Division 01, General Requirements

2. Section 31 20 00 - EARTHWORK: EXCAVATION, FILLING AND GRADING

3. Section 31 22 22 - SOIL MATERIALS

4. Section 31 23 33 - TRENCH EXCAVATION AND BACKFILL

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. In accordance with all Division 01 sections, and the following:

a. Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board [CARB] and the Environmental Protection Agency [EPA].

1.4 PROJECT CONDITIONS OR SITE CONDITIONS

A. Dust Control

1. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.

2. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. Contractor shall be responsible for preparing said Dust Control Plan,

submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.

3. No construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan, if one is required.

4. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.

5. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefor.

B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives, walks or occupied facilities.

   a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authorities having jurisdiction.

   b. Provide alternate routes around closed or obstructed traffic ways if required by Authorities having jurisdiction.

3. Locate and identify utilities.

   a. Call a Local Utility Locator Service (USA – “Underground Service Alert” – [800] 227-2600) for the task of locating any applicable utilities in the area where the Project is located.

4. Carefully remove items indicated to be salvaged and store on Owner’s premises at the Owner’s direction.

PART 2 PRODUCTS

2.1 (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:

1. Protect and maintain all benchmarks and survey control points from disturbance during clearing and demolition operations.

2. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties.

3. Furnish and install temporary protection/barrier fencing surrounding the limits of demolition.

4. Protect trees, plant growth, and features not specifically designated for removal. Locate and clearly flag trees and vegetation to remain or to be relocated.

5. Protect existing improvements designated to remain from damage during construction.

a. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.2 CONSTRUCTION

A. Shrub and Weed Removal:

1. Remove weeds and rooted topsoil to a minimum four (4) inch depth and temporarily stockpile as needed for re-use in finished grading of landscape areas. Remove excess material from the site.

2. Where existing vegetation is to be replaced by new materials, remove contaminated or excess soil from the site and legally dispose of off-site.

B. Existing Site Improvements Removal:

1. Remove existing above and below grade improvements as necessary to facilitate new construction.

a. Remove concrete slabs, sidewalk, curbs, mow strips, gutters, and fence post footings.

1) Neatly saw-cut length of existing pavement to remain before removing existing pavement unless existing full-depth joints coincide with line of demolition. Saw-cut faces vertically.

b. Remove indicated utility improvements within the limits of construction.

1) Excavate for and disconnect utilities designated to be removed. Seal or cap off underground.

2) Coordinate removal and/or relocation of utilities with the appropriate utility agencies.

c. Where existing underground utilities, irrigation pipes, wells, leach fields, or underground tanks are encountered, they must be removed

d. Remove concrete slabs, foundations, and utilities within building footprint.

C. Existing Utilities to Remain or be Relocated:

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

a. Notify the Engineer and the Owner not less than seven (7) days in advance of proposed utility interruptions.

b. Arrange to shut off indicated utilities with utility companies and Owner.

D. Disposal:

1. Legally dispose of all debris (surplus soil materials, unsuitable topsoil, obstructions, demolished materials, waste materials, trash, etc.) resulting from clearing, grubbing, demolition and from construction. Disposal of all materials shall be at a location secured by the Contractor off of the Owner's property.

END OF SECTION

SECTION 31 20 00
EARTHWORK: EXCAVATION, FILLING AND GRADING

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. Excavating soil and other material for surface improvements.

2. Placing fill.

3. Compaction of existing ground and fill.

4. Preparation of subgrade for other improvements.

5. Grading of soil.

B. RELATED SECTIONS

1. Contract General Conditions and Division 01, General Requirements

2. Section 31 11 00 - SITE CLEARING

3. Section 31 22 22 - SOIL MATERIALS

4. Section 31 23 33 - TRENCH EXCAVATION AND BACKFILL

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

B. A Geotechnical Engineering Investigation Report has been prepared for the project by Krazan & Associates; Project No. 012-24185, dated November 20, 2024. A copy of the report is available (for reference only) at the cost of reproduction. Contact Krazan & Associates if a copy of the report is desired.

C. A Limited Geophysical Survey Report has been prepared by Krazan & Associates as a supplement to the Geotechnical Report; Project No. 034-25009, dated April 16, 2025. A copy of the report is available (for reference only) at the cost of reproduction. Contact Krazan & Associates if a copy of the report is desired.

1.4 DEFINITIONS

A. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Product Data:

1. Information indicating the source of all import material, the fill material type and where it is to be used, and approval of the District's Inspector of Record for incorporation of import material into the Work.

B. Material Test Reports:

1. Classification of Soils

2. Compaction Characteristics of Soils

3. Density and Unit Weight of Soils in Place.

4. Imported fill shall be tested and approved by the Owner's Geotechnical Engineer prior to import to the site, including testing for compliance with Department of Toxic Substances Control (DTSC) guidelines. Said testing and certification documents shall be paid for by the Owner.

C. Project Closeout: In accordance with Specification Section PROJECT CLOSEOUT.

1. Drawings indicating the extent and depth of all engineered fill, and overexcavation and recompaction. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with the Specification Section PROJECT DOCUMENTS.

1.6 QUALITY ASSURANCE

A. Installer:

1. Qualifications:

a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:

1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:

a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the

	California Air Resources Board [CARB]
b. CM	City of Merced, codes and Ordinances
c. EPA	Environmental Protection Agency.
d. CAL/OSHA	Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
e. DTSC	Comply with all recommendations of the California Department of Toxic Substance Control (DTSC) regarding soil testing for potential contaminants.

C. Certificates:

1. Installer's certification that all Earthwork installation meets or exceeds the requirements of this specification.

2. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

1. Pre-Installation: Schedule prior to the start of work.

   a. Coordinate the work with other work being performed.

   b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

2. Progress: Scheduled by the Contractor during the performance of the work.

   a. Review for proper installation of work progress.

   b. Identify any installation problems and acceptable corrective measures.

   c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.

   a. Inspect and identify any problems which may impede issuance of warranties or guaranties.

   b. Maintain installed work until the Notice of Substantial Completion has been filed.

1.7 COORDINATION

A. Coordinate work with Owner's personnel.

B. Provide required notification to the Owner and Geotechnical Engineer or the Engineer of Record so that a representative from the Owner's Geotechnical Engineering consultant can be present for all excavation, filling and grading operations to test and observe earthwork construction.

C. Verify that the location of existing utilities has been indicated at work site by utility authorities, by Owner, and as specified on the Plans.

1.8 EXISTING CONDITIONS

A. Existing Conditions:

1. Examine the site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.

2. Thoroughly investigate and verify conditions under which the Work is to be performed.

3. Locate and identify utilities:

a. Call a Local Utility Locator Service (USA - "Underground Service Alert" – [800] 227-2600) for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.

b. Contractor to provide 3rd party utility locating within the limits of the project work area

4. No allowance for Extra Work will be granted resulting from negligence or failure to meet requirements of this Section.

B. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete flatwork, paving, landscaping, signs, etc.), the engineer will have made a diligent attempt to indicate on the plans the location of all main and trunk line utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until located and exposed by the Contractor.

C. Under similar circumstance, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however,

the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until located and exposed by the Contractor.

D. Determine exact location of existing buried utilities by:

1. Utilizing a 3rd party utility locator, mark on ground or pavement surface the alignment and extent of the facilities and the probable location of existing utilities using construction plans and existing surface features.

2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations and notify Owner of said request concurrently.

3. Confirm exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

E. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Contractor's 3rd party utility locator.

F. Provide Field Engineering to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under this Contract, submit detailed information to the Engineer for review and direction.

G. Maintain all existing utility mains and service lines in constant service during construction of the Work.

H. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work, and coordinate the timing of any such disruptions in advance with the District.

I. Existing soils are considered to have a highly corrosive potential to buried metal objects.

J. Existing soils are considered to have a low expansion potential.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.

1. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover.

2. All land clearing, demolition, grubbing, scraping, excavation, land leveling, grading, and cut and fill activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by pre-soaking.

3. When materials are transported off-site, all material shall be covered, effectively wetted to limit visible dust emissions or at least six inches of freeboard space from the top of the container shall be maintained.

4. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. The use of blower devices is expressly forbidden.

5. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/ suppressant.

    a. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.

    b. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. If required, Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.

    c. If a dust control plan is required, no construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan.

    d. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.

    e. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefore

B. Burning: No burning will be allowed on-site.

C. Rain: Work under this section shall not be started or maintained under threat of rain, unless the work is not affected by the rain.

D. Do not place fill during weather conditions which will alter moisture content of fill materials sufficiently to make compaction to the specified densities difficult or impossible.

E. When reference is made to SWPPP (Storm Water Pollution Prevention Plan), if any within this Project Manual, then comply with all environmental protection requirements included therein.

F. In accordance with EPA, CARB and CM.

G. Protection:

1. Protect cut and fill areas to prevent water running into excavation. Maintain areas free of water. Remove seeping water immediately by pumps. Provide dewatering as necessary.

2. Protect cut slopes from erosion due to precipitation and other sources of runoff.

3. Protect utilities to remain within the construction area and special construction. If utility lines are uncovered (water, electric, sewer, etc.) not shown on the drawings during excavation of site, notify the Architect promptly for its review and action.

4. Do not permit access to undeveloped portions of the site, nor to areas that are outside of the limits of grading.

H. Before being brought onto the site, all import soil must be sampled, tested and approved by Owner's Geotechnical Engineer. All import material must comply with DTSC recommendations and guidelines for environmentally clean soil suitable for school construction. Import testing will be provided and paid for by the Owner.

1.10 PROJECT RECORD DOCUMENTS

A. Submit under provisions of GENERAL CONDITIONS and DIVISION 01, GENERAL REQUIREMENTS.

B. Accurately record actual locations of utilities encountered including depth and horizontal location, as measured from permanent site features.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill in Turf or Other Planting Areas: Type S2 or S3 per Division 31 Specification Section 31 22 22 - SOIL MATERIALS

B. Fill in Non-planting Areas: Type S1, S2 or S4 per Division 31 Specification Section 31 22 22 - SOIL MATERIALS.

C. Imported material: Type S3, S4 or S5 per Division 31 Specification Section 31 22 22 - SOIL MATERIALS.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

3.2 PREPARATION

A. Layout of Work:

1. Contractor shall be responsible for all lines and grades. Layout shall be provided by a California registered Land Surveyor or Civil Engineer, at Contractor's expense.

2. Check all benchmarks, monuments and property lines and verify locations.

3. Locate and maintain all grade stakes.

4. Monuments moved or displaced during grading operation are to be replaced by a California Registered Civil Engineer or Surveyor, at Contractor’s expense.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

D. Protect existing structures, fences, curbs, sidewalks, paving and other improvements to remain from damage from excavation equipment and vehicular traffic.

E. Employ equipment and methods appropriate to the work site.

F. Protect excavated areas from drainage inflow and provide for drainage of all excavated areas.

G. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

H. The existing on-site soils contain expansive materials. Protect all areas of exposed soil from becoming very moist, either from precipitation or other site run-on

3.3 SITE STRIPPING:

A. Reference is made to Specification Section 31 11 00 - SITE CLEARING.

B. Within the areas of planned surface improvements and structures, the near surface soils containing vegetation, roots, organics, or other objectionable material must be stripped and removed from the site. Upon approval of the Geotechnical Engineer, suitable materials stripped from the site may stockpiled and incorporated into the finish fill for planting areas.

C. All areas to receive surface improvements shall be stripped to remove turf, shrubs, trees and other vegetation, along with associated root systems, concrete, wood, metal, rubbish and other unsuitable debris, and any loose, saturated or unconsolidated soil material. Minimum stripping depth is expected to be 4-inches below existing site grades. Stripping shall continue to the depth required to expose acceptable basement soils that are free from deleterious which are not suitable for Engineered Fill, as required by the Geotechnical Engineer.

3.4 EXCAVATION

A. Following clearing and stripping operations, over excavate planned construction areas as specified in this Section.

B. Historical records indicate the presence of multiple underground storage tanks that have been removed and backfilled with sand and gravel. Where these areas are encountered, the sand and gravel backfill shall be fully removed until native subgrade is encountered, and the resulting excavations shall be backfilled with engineered fill

C. Within the area of the planned building improvements and the exterior concrete flatwork outside the building, plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 12 inches below the stripped subgrade surface or at least to the bottom of footings, whichever is lower. The intention of the over-excavation for this project is to provide at least 24" of non-expansive engineered fill underneath slabs-on-grade and exterior concrete flatwork, but the building is being raised significantly above existing grade on site, which may reduce the minimum over-excavation depth to 12" in some areas

D. Areas of asphalt concrete improvements should be prepared removing any undocumented fill and scarification of the upper 12-inches below existing grade or 12-inches below the recommended base section, whichever is greater. These soils should be moisture conditioned to slightly above optimum and compacted as engineered fill.

E. Provide additional excavation as required to conform to the lines, grades and cross-sections shown on the plans.

F. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw. Remove all roots 1/4” in diameter and greater.

G. Remove excess soil not to be used as fill in the Work from the site. Unless requested by Owner to be deposited at a site designated by Owner on the property, obtain a

disposal site and legally dispose of said excess material, all at no additional cost to the Owner.

H. Areas disturbed by demolition must be excavated to expose undisturbed soils.

I. The exisiting upper native and fill soils are predominately silty sand, sandy clay, and sandy clay with gravel. The clayey soils will not be sutiable for reuse as non-expansive engineered fill. Silty sand soils with an expansion index of 15 or less, free of deleterious substances (organic matter, demolition debris, tree roots, etc.) and with less than 3% organic content by weight, may be returned to the excavations as Engineered Fill.

J. As an alternative to over-excavating and fillinf as noted above, the contractor may lime-treat the existing on-site, clayey soil per the recommendations of the geotechnical report, and substitute an 18" thick lime-treated subgrade section in lieu of the 24" of compacted Engineered Fill under buildings and flatwork. Lime-treated sections under asphalt pavement may be limited to 12" thick.

3.5 FILLING AND COMPACTING

A. Once clearing, stripping and over-excavation operations are complete, scarify the surface to receive fill material or improvements to a depth of 8-inches, moisture condition to at least 2% above optimum moisture content, and compact to a minimum of 90% of maximum dry density (relative compaction) based on ASTM Test Method 1557.

B. Place and compact soil to finish subgrade of improvements to be placed thereon, or to finished surface grade where no improvements are to be placed thereon.

C. All fill required shall be placed as Engineered Fill.

D. The Contractor shall be solely responsible for securing an acceptable source of import material as required to grade the site. Reference is made to 31 20 00 1.09.H

E. On-site silty sand soils are suitable for re-use as Engineered Fill, providing they are cleansed of excessive organics (less than 3 percent by weight, ASTM D2974), debris, and fragments larger than three (3) inches in maximum dimension and meet the requirements of soil Type S4, Division 31 Specification Section SOIL MATERIALS.

F. Engineered Fill shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding eight (6) inches in thickness, and compacted as specified, based on ASTM Test Method D1557.

1. Non-vegetative surface improvement areas (structures and site concrete improvements) - To a minimum of 90% of maximum dry density (relative compaction).

2. Vegetative surface improvement areas (turf and planters) - Below top twelve (12) inches - to a minimum of 90% of maximum dry density (relative compaction). Top twelve (12) inches - 85% of maximum dry density (relative compaction).

3. Pavement areas: to a minimum 95% of maximum dry density (relative compaction) in top twelve (12) inches.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Additional lifts shall not be placed if the previous lift did not meet the required dry density or relative compaction, or if soil conditions are not stable.

I. Conform fill to the lines, grades and cross-sections shown on the plans.

J. Fill materials to conform to Division 31 Specification Section SOIL MATERIALS.

K. Provide, at no additional cost to Owner, imported soil material conforming to the requirements of Division 31 Specification Section SOIL MATERIALS, as needed to attain finished grades of Work.

L. Utilize equipment which will not disturb or damage existing utilities and other improvements.

3.6 PREPARATION OF SUBGRADE FOR SURFACE IMPROVEMENTS

A. Where concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements, or a layer of said surface improvements, are to be constructed on the soil surface, prepare the subgrade for said improvements in accordance with this section.

B. Scarify the soil as specified and remove and dispose of (off the project site) all rocks, hardpan chunks or otherwise unsuitable material over 3-inches in size.

C. Thoroughly moisture condition and compact as described above.

D. Prior to commencing construction of surface improvements, pass a test roller of size and weight as approved by the Owner over the subgrade to establish the extent of soft or spongy areas requiring repairs.

E. Conform finished subgrade surface to the lines, grades and cross-sections shown on the plans.

3.7 FINE GRADING

A. Fine grade all finished surfaces to the lines, grades and cross-sections shown on the plans, and to blend to hard surface improvements.

B. Rake and smooth all finished surfaces not to receive hard surface improvements.

C. Use suitable stockpiled or imported topsoil for the top 12-inches of areas to receive landscape improvements.

D. Import topsoil meeting the requirements of Division 31 Specification Section SOIL MATERIALS, as required to complete finish grading.

E. Topsoil may not be used in areas requiring Engineered Fill.

3.8 TOLERANCES

A. Top surface of Subgrade for Non-Vegetative Surface Improvements or Layers thereof: Plus or minus 0.02 foot from planned elevation.

B. Top surface of Subgrade for Vegetative Surface Improvements or for Bare Ground - Plus or minus 0.05 foot of planned elevation, or as required for finish surface to match adjacent improvements or ground.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of GENERAL CONDITIONS and/or DIVISION 01, GENERAL REQUIREMENTS.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.

D. All retesting required as a result of failure of initial test will be performed by Owner’s testing agency, at the expense of the Contractor.

3.10 PROTECTION

A. Protect graded areas from traffic, freezing, erosion, and all other sources of damage. Keep free of debris and trash.

B. Repair and re-establish grades to specified tolerances where completed or partially completed work becomes eroded, rutted, settled, or where it is damaged by subsequent construction operations or weather.

C. Where settlement occurs prior to acceptance of the work, remove and replace surface improvements, excavate, replace, and re-compact in accordance with these specifications, and restore the surface improvements.

3.11 CLEANING

A. Remove all surplus or unsatisfactory soil material, trash, and debris, and legally dispose of off of the Owner’s property.

END OF SECTION

SECTION 31 22 22
SOIL MATERIALS

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. Excavated (and re-used) materials and imported materials.

1.3 RELATED SECTIONS:

A. Section 31 20 00 - Earthwork: Excavation, Filling and Grading.

B. Section 31 23 33 - Trench Excavation and Backfill.

1.4 SUBMITTALS

A. Samples: Submit, in air-tight containers, 10 lb. sample of Type S3, S4 and S5 fill to inspector.

B. Soil Analysis: Submit for Type S3, S4 and S5 soils to be imported.

C. Materials Source: Submit location of imported materials source. Provide materials from same source throughout the work. Change of source requires approval.

D. For imported soil, obtain Geotechnical Engineer and District approval prior to importing.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Soil Type S1: Excavated and reused material, graded; free of clayey soils, lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Soil Type S2: Excavated and reused material, graded; free of clayey soils, roots, lumps greater than one inch, rocks larger than 1/2 inch, debris, weeds and foreign matter.

C. Soil Type S3: Imported topsoil, friable loam; reasonably free of roots, rocks larger than ½ inch, debris, weeds, and foreign matter.

D. Soil Type S4: Imported borrow, suitable for purposes intended, meeting the following characteristics:

1. Maximum Particle Size: 4”

2. Percent Passing #200 Sieve: 20-50

3. UBC Standard 29-2 Expansion Index: <15

4. Plasticity Index: <10

5. R-Value (in paved areas): >50

6. Low Corrosion Potential:

    a. Soluble Sulfates: <1,500 mg/Kg

    b. Soluble Chlorides: <300 mg/Kg

    c. Soil Resistivity: >5,000 ohm-cm

E. Soil Type S5: Imported sand. Natural river or bank sand (sand equivalent greater than 30), washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

F. Soil Type S6: Bioretention Planting Medium

1. Mixture of sand (60-70%) meeting the specifications of ASTM C33 and compost (30%-40%) shall be used per the City of Merced Post-Construction Standards Plan

2.2 SOURCE QUALITY CONTROL

A. Inspection of imported soil will be performed by the Geotechnical Engineer, at source of import and prior to being delivered to the site.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile excavated or imported material onsite at location designated by project inspector.

B. Stockpile excavated or imported material in sufficient quantities to meet project schedule and requirements.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

B. Dispose of excess material off-site.

END OF SECTION

SECTION 31 23 33
TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Geotechnical Report prepared by Krazan & Associates, Project number 012-24185, dated November 20, 2024.

C. Limited Geophysical Survey Report by Krazan & Associates, Project number 034-25009, dated April 16, 2025.

1.2 SUMMARY:

A. SECTION INCLUDES

1. Excavating trenches, holes and pits for constructing the Work.

2. Backfill and compaction.

3. Providing suitable bedding and backfill material, as specified herein.

B. RELATED SECTIONS

1. Contract General Conditions and Division 01, General Requirements.

2. Section 31 11 00 - Site Clearing

3. Section 31 20 00 - Earthwork: Excavation, Filling & Grading

4. Section 31 22 22 - Soil Materials

5. Section 33 12 00 - Water Utilities

6. Section 33 30 00 - Site Sewer Systems

7. Section 33 40 00 - Storm Drainage

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

1.4 DEFINITIONS

A. Utility: Any buried or above ground pipe, conduit, cable, associate devices or appurtenances, or substructure pertaining hereto.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Installer:

a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:

1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:

a. CARB	Materials and equipment shall comply with the current applicable regulations of the California Air Resources Board [CARB]
b. CM	City of Merced
c. EPA	Environmental Protection Agency
d. CAL/OSHA	Comply with all provisions of the Construction Safety Orders and the Feneral Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.

C. Certificates:

1. Installer’s certification that all trench backfill installation meets or exceeds the requirements of this specification.

2. Contractor’s certification (on Contractor’s letterhead paper) that the trench backfill materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

1. Pre-Installation: Schedule prior to the start of work.

a. Coordinate the work with other work being performed.

b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

2. Progress: Scheduled by the Contractor during the performance of the work.

    a. Review for proper installation of work progress.

    b. Identify any installation problems and acceptable corrective measures.

    c. Identify any measures to maintain or regain project schedule if necessary.

3. Completion: Scheduled by the Contractor upon proper completion of the work.

    a. Inspect and identify any problems which may impede issuance of warranties or guaranties.

4. Maintain installed work until the Notice of Substantial Completion has been filed.

1.6 COORDINATION

A. Coordinate work with Owner's personnel.

B. Verify that the location of existing utilities have been indicated at work site by utility authorities.

1.7 EXISTING UTILITIES

A. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until located and exposed by the Contractor.

B. Under circumstance similar to 31 23 33/1.7A, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until located and exposed by the Contractor.

C. Determine exact location of existing buried utilities by:

1. Utilizing a 3rd party utility locator, mark on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.

2. Requesting Underground Service Alert to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations and notify owner of said request concurrently.

3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

D. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Contractor's 3rd party utility locator.

E. Provide Field Engineering per Contract General Conditions and Division 01 to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under the Contract, submit detailed information to the Owner’s Inspector and Engineer for review and direction.

F. Maintain all existing utility mains and service lines in constant service during construction of the Work.

G. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill Type S1, S2, S4 and S5, as specified in Division 31 Specification Section SOIL MATERIALS.

2.2 WARNING TAPE

A. 6” wide warning tape shall be installed over all of the pipelines as shown on the details.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

B. Protect existing structures, fences, sidewalks, curbs, and other improvements from excavation equipment and vehicular traffic.

C. Maintain and protect above and below grade utilities which are to remain.

D. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.2 EXCAVATION

A. Excavate soil required to locate existing utilities and install the work.

B. Use hand methods of excavation to locate existing utilities, and to excavate trenches, pits and holes in congested areas.

C. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined by hand methods of excavating.

D. Cut trenches just wide enough to enable installation and proper bedding and backfill, and to allow inspection.

E. Do not interfere with the 2:1 bearing splay of foundations.

F. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose material.

G. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings, and then backfill to the pipe grade with Type S2 or S5 material, containing sufficient moisture to allow compaction to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such over-excavation and refill.

H. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure, and backfill the space with Type S2 or S5 material containing sufficient moisture to allow compaction to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such additional excavation or backfill.

I. Excavate trenches to provide the design grade of the facility, or as directed by the Engineer.

J. Stockpile excavated material to be returned to trench adjacent thereto in location which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove from site all unsuitable or excess material not to be used.

K. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.

L. Remove excess soil not used as backfill from the work site. Obtain a disposal site off of the Owner’s property and legally dispose of said excess material, all at no additional cost to the Owner.

M. If water is encountered during excavations, provide all dewatering measures necessary to construct improvements shown.

N. Contractor shall make all provisions necessary, including but not limited to, shoring or sloping back trench walls as required to address sandy soils. The cost of these provisions shall be included in the lump sum amount bid for this work and no separate payment will be made therefore.

3.3 PROTECTION OF EXCAVATIONS

A. Provide all shoring and bracing as required and those codified in local, state and federal safety regulations.

B. Prevent water, caving or sloughing ground from entering excavations.

C. Maintain excavations free of water.

3.4 BACKFILLING

A. Provide type S2 or S5 pipe bedding as required by Plans and compact to 90% maximum dry density (relative compaction). Soil Type S2 shall meet requirements of Type S5.

B. After installation of pipes and appurtenances and placement of pipe bedding material, backfill trenches and excavations to finished grade, or subgrade in areas to receive surface improvements

C. Backfill trenches above pipe bedding material and to within 24 inches of finish subgrade with Type S1, S2, S4, or S5 soils, except that that top 12 inches shall be type S2, S3, S4 or S5 soils.

D. Employ a placement method that does not disturb or damage existing or proposed pipes or other Utilities or Improvements.

E. Place and compact all soil backfill in continuous layers not exceeding 8 inches in loose uncompacted thickness, moisture condition to at least 3% above optimum moisture content.

F. Maintain optimum moisture content of fill materials to attain required compaction.

G. Backfill final 12-inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type S2, S4, or S5 soils.

H. Backfill final 12-inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil, with Type S2 or S3 soils.

I. Compact backfill below the top 12-inches to 90% maximum dry density (relative compaction).

J. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 90% maximum dry density (relative compaction).

K. In areas to receive asphalt concrete pavement or concrete pavement subject to vehicular traffic, compact the top 12-inches to 95% maximum dry density (relative compaction).

L. In planting areas, compact the top 12-inches to 85% maximum dry density (relative compaction).

3.5 TOLERANCES

A. Top Surface of Backfill under Paved or Concrete Areas: Plus or minus 0.02 feet from required elevations.

B. Top Surface of General Backfilling: As required for finish surface to match adjacent improvements or ground.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of General Conditions and/or Division 01.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, and retest. Retests required due to failure of initial tests shall be paid for by the Contractor.

3.7 PROGRESS AND PROSECUTION

A. Backfill any excavation opened in any day on that same day.

END OF SECTION

SECTION 32 11 26
AGGREGATE BASE COURSE

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. Provide all material, labor, equipment and services necessary to install aggregate base surfacing as indicated by the Contract Documents.

1.3 RELATED SECTIONS

A. All Division 00 Specification Sections

B. All Division 01 Specification Sections

C. Section 31 20 00 – Earthwork: Excavation, Filling, and Grading.

D. Section 31 23 33 – Trench Excavation and Backfill.

E. Section 32 12 16 – Soil Sterilization.

F. Section 32 12 17 – Asphalt Paving.

G. Section 32 13 13 – Site Concrete Improvements.

1.4 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials

1.5 QUALITY ASSURANCE

A. Provide and install in accordance with SSCDOT.

1.6 SUBMITTALS

A. Submit data sheets from supplier to document compliance with SSCDOT requirements.

B. Certificates of compliance for material.

C. Load tags for delivered material.

1.7 COORDINATION

A. Coordinate with other work, including subgrade preparation and soil sterilization.

B. Coordinate installation schedule with Owner's use of the premises and with other contractors working at the site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base: Unless specified otherwise on Plans, Class 2, 3/4 Inch Maximum per Section 26 of SSCDOT.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify quantities required.

B. Verify that subgrade has been placed and compacted per Contract Documents

C. Verify gradients and elevations of subgrade are correct.

3.2 INSTALLATION OF AGGREGATE BASE COURSE

A. Install in conformance with SSCDOT Section 26, Aggregate Bases.

B. Thickness - As shown on construction drawings.

C. Spreading and Compacting - In accordance with Section 26, SSCDOT. Base course shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding six (6) inches in thickness, and compacted as specified, based on ASTM Test Method D1557. The relative compaction of each layer of compacted base material shall be not less than 95 percent.

D. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities, true to grade and cross-section.

E. Lines and grades for the installation of aggregate base shall be set by a California licensed Land Surveyor or Civil Engineer, at Contractor's expense.

3.3 TOLERANCES

A. Compacted thickness of aggregate base: Not less than the thickness specified on the Plans.

B. Finished Surface: Within 0.02 foot of planned grade per Section 26, SSCDOT. No more than 50% of the finish surface shall be above or below the specified grade for aggregate base.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by the Owner's inspector, under provisions of Division 01.

3.5 PROTECTION

A. Immediately after placement and compaction, protect surface from mechanical injury.

B. Protect completed surface until surfacing layers are in place.

END OF SECTION

SECTION 32 12 16
SOIL STERILIZATION

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 the work specified in this section.

1.2 SECTION INCLUDES

A. Furnish and install soil sterilant under all asphalt paving.

1.3 RELATED SECTIONS

A. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading

B. Section 31 23 33 - Trench Excavation and Backfill

C. Section 32 11 26 – Aggregate Base Course

D. Section 32 12 17 – Asphalt Paving

E. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to the work of this section.

1.4 STANDARDS

A. In accordance with the following:

CCR-T21	California Code of Regulations, Title 21 Public Works.
CBC	California Building Code, California Code of Regulations, Title 24, Part 2, CCR-T24
USDA	United States Department of Agriculture.
EPA	Environmental Protection Agency
CM	City of Merced

B. All applicable Environmental Regulations and Standards

1.5 QUALITY ASSURANCE

A. Provide licensed operator to apply soil sterilant.

B. All products shall comply with the current EPA laws at time of application. Should the products listed become unavailable because of changes in the law, submit substitute products for review by the Owner.

1.6 SUBMITTALS

A. Submit in accordance with Specification Section SUBMITTAL PROCEDURES.

B. Certificates of application.

C. Certificates of compliance for material.

1.7 COORDINATION

A. Coordinate with other work, including subgrade preparation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Soil Sterilant: Bayer Oust XP, weed and grass preventer, or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that site is ready for application.

3.2 PREPARATION

A. Identify installation locations.

B. Employ equipment and methods appropriate to the work site.

3.3 APPLICATION

A. Thoroughly water soak surface to be treated. Avoid excessive water runoff.

B. Apply sterilant solution over surface to receive pavement or surfacing prior to the start of pavement or surfacing installation.

C. Apply in spray form, at rate as allowable by State of California and the manufacturer's recommended application rate.

D. Take all precautions to limit soil sterilant solution to areas immediately under proposed pavement or surfacing. Use shields as necessary, and do not apply under windy conditions.

END OF SECTION

SECTION 32 12 17
ASPHALT PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all pavement materials, accessories and other related items as required by the Contract Documents.

1.3 RELATED SECTIONS:

A. All Division 00 Specification Sections

B. All Division 01 Specification Sections

C. Section 31 22 00 - Earthwork: Excavation, Filling, and Grading

D. Section 31 23 33 - Trench Excavation and Backfill

E. Section 32 11 26 - Aggregate Base Course.

F. Section 32 12 16 - Soil Sterilization.

1.4 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SSCDOT.

B. Mixing Plant: Conform to SSCDOT.

C. Installation Criteria: Asphalt concrete shall show no evidence of cracking, uneven settlement, improper drainage, or untoward junctions with adjoining or existing surfaces. Work displaying such conditions shall be corrected under the Contractor's guarantee of all work.

1.6 SUBMITTALS

A. Submit under provisions of Division 01.

B. Mix design

C. Certificates of compliance for material.

D. Load tags for delivered material.

1.7 COORDINATION

A. Coordinate with other work, including subgrade preparation, aggregate base placement and soil sterilization.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt-concrete when atmosphere temperature is less than 50 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paint Binder: In accordance with SSCDOT Section 94, Asphaltic Emulsions.

B. Asphalt-Concrete: Type A in accordance with Section 39, SSCDOT, ½ inch or ¾ inch maximum aggregate (medium) as indicated on the Plans. The asphaltic concrete shall be compacted to an average relative compaction of 97 percent, with no single test value being below a relative compaction of 95 percent based on a 50 blow Marshall maximum density. Use asphalt binder performance grade PG 64-10.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify quantities required. New asphalt-concrete paving is required at all locations shown on the plans, and where existing asphalt-concrete paving to remain is removed or damaged by the Project excavation or related work.

B. Verify that subgrade or base material has been compacted to required relative compaction and is dry.

C. Verify gradients and elevations of base are correct.

D. Verify that subgrade or base material has been sterilized per Section 32 12 16 SOIL STERILIZATION.

3.2 AGGREGATE BASE

A. Where shown on the construction plans, place and compact aggregate base course per Section 32 11 26 AGGREGATE BASE COURSE.

B. Where shown on the construction plans, place asphalt on compacted earth subgrade per Section 31 20 00 EARTHWORK: EXCAVATION, FILLING AND GRADING and Section 31 23 00 TRENCH EXCAVATION AND BACKFILL.

C. A soil sterilant shall be applied over the entire area which is to be paved in accordance with Section 31 12 16 SOIL STERILIZATION

3.3 PREPARATION – PAINT BINDER

A. Apply paint binder to existing asphalt-concrete or concrete surfaces which will be in contact with asphalt-concrete surfacing.

B. Rate of application for all surfaces against which asphalt concrete is to be placed shall be no less than 0.02 and no more than 0.05 gallons per square yard. All vertical concrete surfaces which will be in contact with asphalt concrete surfacing and all areas now in place which will be covered with new surfacing materials and feathering operations shall be coated with a paint binder applied at the rate of 0.05 gallons per square yard.

3.4 INSTALLATION OF ASPHALTIC-CONCRETE

A. Install in conformance with SSCDOT Section 39, Asphalt-Concrete.

B. Thickness - As shown on construction plans. Where thickness exceeds 3 inches, place in no less than 2 layers with top layer no thinner than one and a half inches. Asphaltic concrete shall be laid to the thickness designated on the Plans. The plan thickness is to be considered as a minimum thickness. The Contractor shall lay the asphaltic concrete to a depth required to ensure that, after compaction, the in place compacted thickness is equal to or greater than the specified plan thickness.

C. The Contractor shall provide to the Engineer the truck delivery weight tags for the asphaltic concrete material. The quantity delivered shall be equal to or greater than the calculated in place quantity based on the specified thickness and area to be paved as designated on the construction plans and based on a unit density of the asphaltic concrete of 141 pounds per cubic feet.

D. Asphalt type: PG 64-10

E. Compaction Equipment - In accordance with Section 39, SSCDOT. At small difficult areas, equipment may be altered as approved by Engineer.

F. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities and to be true to grade and cross-section.

3.5 TOLERANCES –GENERAL

A. Finished Surface: within 0.02 foot of planned grade.

B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Not less than specified.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Pavement shall comply with the following:

1. Water shall not be able to accumulate at any point and the surface shall be free to drain to drainage inlets or gutters.

2. The paving contractor shall water flood the surface with the use of a water truck. If, after 30 minutes on a 70 degree F day, “bird baths” are evident in a depth more than 0.01 foot, the paving contractor and the Owner’s representative will determine the best method of correction.

3. A 10 foot straightedge shall be used to check for high spots and ridges. High spots and ridges out of compliance shall be reduced by a remedy determined by the paving contractor and the Owner’s representative.

C. Should a section of the work be not acceptable on the basis of inadequate compaction and/or the mixture becomes loose and broken, mixed with dirt, out of tolerance, or in any other way defective, it shall be repaired or removed and replaced with fresh mixture and immediately compacted to conform to the surrounding area to the satisfaction of the Owner.

3.7 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury.

B. Protect sealed surface until it is cured.

END OF SECTION

SECTION 32 13 13
SITE CONCRETE IMPROVEMENTS

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. All material, labor, equipment and services necessary to completely install exterior Portland cement flatwork, cast-in-place concrete, and architectural flatwork concrete, accessories and other related items, slabs, ramps and sidewalks and walkways, curb and gutter, mowstrips, and other miscellaneous concrete items of the form and dimensions shown on the plans and necessary to complete the project, and in accordance with the requirements of the Standard Specifications as modified and supplemented by these Special Provisions

2. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to the work of this section.

B. RELATED SECTIONS:

1. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading

2. Section 32 11 26 - Aggregate Base Course.

3. Section 32 13 15 - Concrete Reinforcement

1.3 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

B. ACI standards, including but not limited to #304, 305, 306, 308, 309 and 347.

C. ASTM standards, including but not limited to #C-33, C-39, C-94, C-136, C-143, C-150, and C-309.

1.4 SUBMITTALS

A. Submit under provisions of Specification Section SUBMITTALS.

1. Certificates of compliance for materials and mix designs.

2. Load tags for delivered material.

3. Strength testing as required by the approving agency.

4. Application instructions for the architectural finish materials.

5. Accessories and manufacturer's installation specifications.

1.5 QUALITY ASSURANCE

A. Furnish concrete materials conforming with SSCDOT.

B. Perform work in accordance with SSCDOT, unless noted otherwise herein.

PART 2 PRODUCTS

2.1 MIXES

A. Mix Design and Proportions in accordance with SSCDOT:

1. Mix designs with Fly Ash content no greater than 15 percent of the total weight of cementitious materials shall be proportioned by SSCDOT.

2. Provide a maximum of 4 percent air entrainment, unless noted otherwise.

3. Owners Testing laboratory shall review all mix designs before submittal.

4. All concrete shall have the following minimum compressive strengths in accordance with ACI 318 and SSCDOT at 28 days and shall be proportioned within the following limits:

a. Site Concrete: Use for exterior concrete slabs on grade including, but not limited to sidewalks, curbs, gutters, mow strips, utility appurtenances and miscellaneous site improvements.

1) Strength: 3,000 psi at 28 days

2) Maximum Aggregate Size: 1-inch

3) Cement Type: Type II/V

4) Cement Content: 5.5 sacks/yd minimum

5) Max Water/Cement Ratio: Per SSCDOT

6) Admixture: Per SSCDOT

7) 4" Slump

b. Structures & Vehicular Concrete Paving: Use for site structures, foundations, and exterior slabs on grade subject to vehicle traffic.

1) Strength: 4,000 psi at 28 days

2) Maximum Aggregate Size: 1-inch

3) Cement Type: Type II/V

4) Cement Content: 6.5 sacks/yd minimum

5) Max Water/Cement Ratio: Per SSCDOT

6) Admixture: Per SSCDOT

7) 4" slump

c. Slurry Backfill: Use for backfill of over-excavated trenches, encasement of all penetration, and site utility piping.

1) Maximum Aggregate Size: 3/8-inch

2) Cement Type: Type II/V

3) Cement Content: 2.0 sacks/yd minimum

B. Reinforcement shall comply with relevant portions of Division 32 Specification Section CONCRETE REINFORCEMENT.

PART 3 EXECUTION

3.1 PREPARATION

A. Subgrade shall conform to the requirements of Division 31 Specification Section EARTHWORK: EXCAVATION, FILLING AND GRADING. The District may elect to verify compacted subgrade elevations by measurement made from adjacent existing improvements or by a template supported by forms.

3.2 GENERAL CONCRETE

A. Concrete placement shall conform to the applicable requirements of Standard Specification Sections 51 and 90. Concrete shall not be placed when the air temperature in the shade at the project site exceeds 95º F or is below 45º F, or when the temperature of the concrete exceeds 85º F.

B. After the concrete has been placed, it shall be struck off to proper section and compacted with a grid of parallel metal bars until a layer of mortar not less than 3/8 inch thick has been brought to the surface. All exposed concrete surfaces shall receive a medium broom finish applied transversely to the line of pedestrian traffic or to the longest dimension of the concrete, as applicable.

C. General concrete surfaces shall be cured by the curing compound method and shall be protected in accordance with the provisions of Subsections 90-1 and 90-2 of the Standard Specifications.

3.3 PROTECTION OF CONCRETE

A. The Contractor shall be responsible for the condition of all concrete work until such time as all work has been completed and is accepted by the District. The Contractor shall limit vehicular travel across concrete until such time as the concrete has achieved strength sufficient that it can support traffic without damage. In no case, however, will vehicles be allowed to travel across new concrete improvements until seven calendar days have passed since the concrete was placed.

3.4 CONCRETE JOINTS

A. Expansion joints and weakened plane joints shall be constructed at the locations shown on the plans or as directed by the Engineer. Where joint locations are not specified on the plans, expansion joints shall be constructed at maximum intervals of 30 feet, and weakened plane joints shall be constructed at maximum intervals of 10 feet.

B. Expansion joints shall be considered as weakened plane joints for the purpose of spacing weakened plane joints. Expansion joints shall be tooled with a 1/4 inch maximum radius edger, and shall be filled with 3/8 inch pre-formed expansion joint filler.

3.5 CONCRETE FINISHES

A. Where concrete is being installed adjacent to or near existing concrete improvements, match the finish of similar concrete surfaces (i.e. new sidewalks shall match existing sidewalks, new curbs shall match existing curbs, etc.).

B. Sidewalks and Mowstrips: Medium sweat finish or medium broom finish perpendicular to the direction of travel.

C. Curbs: Trowel smooth and finish with a light brush.

D. Gutters: Medium broom finish parallel with curb or direction of flow.

E. Drive approaches and wheelchair ramps: medium broom finish, perpendicular to the direction of travel.

3.6 INSTALLATION OF ACCESSORIES

A. Strictly comply with manufacturer's instructions and recommendations and approved details. Securely anchor work to substrate.

3.7 REPAIR AND CLEAN-UP

A. Contractor shall legally remove all trash, debris, containers and excess materials from the site on a periodic basis, and shall keep the work broom clean until Owner's acceptance.

B. The Contractor shall be held responsible for the repair and/or replacement of new or existing improvements damaged as a result of this work to the satisfaction of the Owner.

C. The Contractor shall provide roll-off bins for wash-out of ready mix concrete trucks and pumpers. Do not allow concrete debris or cement water onto soils scheduled for landscape planting.

END OF SECTION

SECTION 32 17 13
PARKING LOT FURNITURE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install signs, posts and concrete wheelstops

1.2 RELATED SECTIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to the work of this section.

B. Section 32 12 17 – Asphalt Paving

C. Section 32 13 13 – Site Concrete Improvements.

1.3 REFERENCES

A. SSCDOT Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment.

B. CBC – California Building Code, latest edition.

1.4 SUBMITTALS

A. Submit under provisions of Specification Section - SUBMITTAL PROCEDURES.

1.5 COORDINATION

A. Coordinate work with Owner’s personnel.

PART 2 PRODUCTS

2.1 MATERIALS

A. Signs: As per detail drawing.

B. ADA Accessible Signs: As per detail drawing.

C. Sign Posts: 2 inch diameter galvanized iron pipe, A 120, Schedule 40, unless otherwise shown on drawing.

D. Concrete for Sign Footings: Specification Section - SITE CONCRETE IMPROVEMENTS

E. Wheelstop: 3 or 4 feet long pre-cast concrete per detail drawing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing and proposed site conditions.

3.2 PREPARATION

A. Identify installation locations.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Employ equipment and methods appropriate to the work site.

3.3 INSTALLATION

A. Install all sign posts straight and plumb in concrete footings as shown on plans.

B. Secure all signs to posts with vandal resistant galvanized hardware furnished by the Contractor.

C. Orient direction of all signs as indicated on the plans.

D. Install concrete wheelstops at locations shown on drawings. Anchor each wheelstop with two deformed reinforcing bars driven into the asphalt concrete pavement per detail drawing.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under Division 01.

END OF SECTION

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Furnishing and installing paint parking stall, traffic marking and wording on asphalt concrete surfaces.

B. Furnishing and installing disabled marking and hatching area on asphalt concrete pavement.

1.2 RELATED SECTIONS:

A. Section 32 12 17 – Asphalt Paving.

B. Section 32 13 13 – Site Concrete Improvements.

C. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to the work of this section.

1.3 REFERENCES

A. SSCDOT Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment and to furnishing of materials by State.

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Certificates of compliance for materials.

1.5 COORDINATION

A. Coordinate work with other work, including associated traffic signing.

B. Commence striping or marking of asphalt concrete no sooner than 7 days following any sealing of the asphalt concrete.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paint: Quick drying, high visibility water soluble acrylic striping paint; Stripe Master, Wikel Mfg. Company, or similar by Sherwin Williams, J.E. Bauer, or PPG, or approved equal.

B. Paint shall be of color indicated on the construction plans.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that site is ready for application.

3.2 PREPARATION

A. Identify installation locations. Place parking stall striping, traffic marking, wording, international symbol of accessibility and access striping at locations, as shown on construction plans.

B. Thoroughly clean all surfaces to be painted.

C. Employ equipment and methods appropriate to the work site.

D. Provide vehicular and traffic controls per Division 01.

3.3 INSTALLATION

A. Apply paint striping and marking as indicated on the plans.

B. Apply paint uniformly, straight and true, with equipment designed for traffic striping and marking applications.

C. Apply paint striping and marking per Section 84 of SSCDOT, except supply paint conforming to 2.01 A. of this specification.

D. Apply a minimum of 2 separate coats of paint at all striping and marking locations, including asphalt concrete and concrete surfaces.

E. Paint international symbol of accessibility at the location as shown on the plans.

F. Paint accessible access area striping at the location as shown on the plans.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Division 01.

END OF SECTION

SECTION 32 31 11
GATE OPERATORS

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. Gate operators for slide gates.

2. Controls for gate operators.

1.3 RELATED SECTIONS

A. Section 31 13 13 - Site Concrete Improvements

B. Section 32 31 19 - Ornamental Metal Fences and Gates

1.4 SUBMITTALS

A. Product Data: For each type of product, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for gate operators, including operating instructions, motor characteristics, and controls.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include accessories, hardware, gate operation, and operational clearances.

2. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.

3. Wiring Diagrams: For power, signal, and control wiring

C. Closeout Submittals

1. Operation and Maintenance Data: For gate operators to include in operation and maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure to comply with performance requirements.

    b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

    c. Faulty operation of gate operators and controls.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. Operators: Factory-assembled, automatic, gate-opening system designed for gate size, type, weight, and frequency of use. Control system shall have characteristics suitable for Project conditions, with control stations, safety devices, and weatherproof enclosures.

1. Operator design shall allow for removal of cover or motor without disturbing limit-switch adjustments and without affecting auxiliary emergency operation.

2. Electronic components shall have built-in troubleshooting diagnostic feature.

3. Unit shall be designed and wired for both right-hand/left-hand opening, permitting universal installation.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

C. UL Standard: Manufacture and label gate operators according to UL 325.

D. Motors: Comply with NEMA MG 1

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

3. Service Factor: 1.15.

E. Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA 250, Type 3R enclosure for surface mounting n=and with space for additional optional equipment.

2.2 MANUFACTURERED GATE OPERATOR UNITS

A. Slide Gate Operator

1. Manufacturer: Liftmaster

2. Model: INSL24UL

3. Rated duty cycle: Continuous duty

4. Meet UL325, UL 991, ASTM F2200, cand CAS C22.2 No. 247

5. Power: 120/240 VAC, single phase

6. Operation: Gear Driven

7. Motor: 24 VDC, continuous duty type, sized to gate conditions

8. Traveling Speed: 6-12 inches per second

9. Powder coated steel riser: Liftmaster MRIN

2.3 ACCESS CONTROLS

A. Keypad: LiftMaster KPW250 Commercial keypad

B. Remote Transmitters: Liftmaster 893MAX 3-button remote controls

1. Provide 10 remotes

2.4 SAFETY DEVICES

A. Photoelectric Safety Sensors

1. UL 325 compliant monitored photo eyes. Reverses gate operation upon obstruction

2. LiftMaster LMRRUL or approved equal

B. Edge Sensors: UL 325 compliant monitored edge sensor

1. Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated

C. Vehicle Detection

1. Safety Loop Detectors: Provide two-channel inductive loop detectors for fail-safe operation. Detectors shall hold gate in the open position or prevent closing while a vehicle is present.

2. Exit Loop: Provide a dedicated loop and detector to automatically open the gate upon vehicle approach from the interior side where shown on plans.

3. Detector modules shall be UL listed and fully compatible with the specified operator

2.5 EMERGENCY ACCESS

A. Fire Department override switch: Knox Box or Knox Key Switch as required by local Authority Having Jurisdiction

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including equipment bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before parking control equipment installation.

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

D. Examine areas and conditions, with Installer present, for compliance with requirements for pavement work, and other conditions affecting performance of the Work.

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

3.2 GATE-OPERATOR INSTALLATION

A. Install gate operators according to manufacturer’s written instructions.

B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at the locations according to gate-operator component manufacturer’s written instructions and as indicated.

C. Vehicle Loop Detector System: Cut grooved in pavement, bury, and seal wire loop according to manufacturer’s written instructions. Connect to equipment operated by detector.

D. Ground electric-powered motors, controls, and other devices according to CEC and manufacturer’s written instructions.

3.3 GROUNDING AND BONDING

A. Comply with requirements in division 26 Section "Grounding"

3.4 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortions, nonalignment, misplacement, disruptions, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.

1. Test and adjust operators, controls, and safety devices. Replace damaged and malfunctioning controls and equipment.

2. Lubricate operator and related components.

C. Lubricate hardware and other moving parts.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Provisions of constructing chain link fence at locations shown on the Construction Documents, including but not limited to:

a. Site chain link fencing and gates.

B. RELATED SECTIONS

1. Contract General Conditions and Division 01 Specifications.

2. Section 312000 – Earthwork: Excavation, Filling, and Grading

3. Section 321313 – Site Concrete Improvements.

1.2 QUALITY ASSURANCE

A. Qualifications of Installer

1. Throughout the progress of installation of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.

2. In actual installation of the work of this Section, use adequate numbers of skilled workmen to insure installation in strict accordance with the contract documents.

3. In acceptance or rejection of work performed under this Section, the Engineer will make no allowance for lack of skill on the part of the workmen.

1.3 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect the materials of this Section before, during and after installation, and to protect the work of other trades.

B. Replacements

1. In the event of damage, immediately make all repairs and replacements necessary to the satisfaction of the Engineer and at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

A. The materials and fabrication of chain link fabric shall conform to these specifications, and as shown on the plans and details.

B. All ferrous materials shall be new and galvanized. Imperfectly galvanized material or material upon which serious abrasions of the galvanizing occur shall not be used.

C. Height - all fencing shall stand at the heights shown on the plans.

D. Fabric

1. Standard: Chain link fabric shall conform to ASTM, designation: A392, Class 1. The wire used in the manufacture of the fabric shall be 9-gauge. All chain link fabric shall be woven into approximately 2-inch mesh. Fabric shall be furnished with knuckling at all selvages. The knuckled selvage shall be used along all corners and edges. Fabric shall be GBW, galvanized before weaving.

2. Vinyl Coated: In addition to meeting the coating and material requirements of the standard chain link fabric described above, all fence and gate parts of fence noted as vinyl coated shall have a black vinyl clad coating. Coating of fabric shall be bonded of 0.015 inch thickness.

E. Posts, braces and gate frames

1. The base material for the manufacture of steel pipe used for posts and braces shall conform to the specifications of ASTM, designation: A53 Type A, standard weight, Schedule 40, and the base material for the manufacture of other steel sections used for posts and braces shall be good commercial quality weldable steel.

a. Where indicated on the plans, all post and rails shall be powder coated to match black vinyl coated chain link fence fabric.

2. All posts, braces and gate frames shall conform to the size and weight designations shown on the plans.

3. All posts shall be fitted with rainproof caps designed so as to fit securely over the top of the posts.

4. All posts shall be of a total length of not less than the depth of the concrete footing as shown on the plans, plus the length required above ground.

5. Posts and braces shall be galvanized in accordance with specifications of ASTM, designation: A123.

6. All horizontal braces shall be attached to posts by approved steel fixtures.

F. Fittings

1. Stretcher bars and other required fittings and hardware shall be steel and shall be galvanized in accordance with the specifications of ASTM, designation: A153.

a. Where indicated on the plans, all fittings shall be powder coated to match black vinyl coated chain link fence fabric.

G. Gate Holdbacks

1. All swinging gates and walk gates shall be installed with a gate holdback, Trimco 1209HOHA-626. Holdbacks shall be installed in the concrete mowstrip, unless otherwise noted.

H. Concrete mowstrip shall be in accordance with Section 321313 SITE CONCRETE IMPROVEMENTS.

I. Accessible Walk gates shall be constructed as per detail drawing and in accordance with CBC sections 11B-206.5 and 11B-404.

1. Gate latch hardware shall be accessible lever type that requires a maximim of 5 pounds of pressure to operate.

a. Schlage ND Series, Rhodes Lever or approved equal.

2. Accessible gates shall have a minimum 10 inch high steel bottom kickplates on both sides of the gate.

3. Hinges shall be heavy duty malleable iron.

J. Non-accessible swinging gates shall comply with the following:

1. Have a lockable fork latch.

2. Have heavy-duty malleable iron hinges

PART 3 EXECUTION

3.1 INSTALLATION

A. All posts shall be set in concrete footings as shown on the plans to within 3 inches of bottom.

B. All vertical line and end posts shall be braced to the nearest adjacent vertical post with galvanized horizontal braces as shown on the plans.

C. Welding

1. All welding shall conform to the requirements of the Uniform Building Code, UBC, Chapter 22.

2. Where the galvanized surface has been burned by welding, all surfaces of the welded connections shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed. The damaged area and weld shall then be painted in accordance with the following details.

    a. All galvanized, welded, or damaged surfaces that are to be painted shall first be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.

    b. After washing, all areas shall be roughened by abrasive blasting using an abrasive that is no larger than 30-mesh. Galvanizing shall not be removed by this operation.

    c. After preparation, all galvanized surfaces that are to be painted shall be covered with one application of zinc dust-zinc oxide primer, federal specification TT-P-641, Type II. The zinc dust-zinc oxide paint shall be applied by spraying to produce a complete covering of the galvanized surface.

    d. After the application of the zinc dust-zinc oxide paint, one application of pre-treatment, vinyl wash primer, Section 91-2.7 of the state Standard Specifications, shall be applied to such surfaces. The vinyl wash primer shall be applied by spraying to produce a uniform wet film on the surface.

    e. Such surfaces shall then be covered with two separate applications of white tint base vinyl finish coat, Section 91-2.22 of the state standard specifications, sufficient to completely cover the preceding color. Paint for the first application shall be tinted with a compatible coloring agent to slightly contrast with the color of the second application. After drying for 24 hours, one application of aluminum paint, finish coat, Section 91-2.8 of the state standard specifications, shall be painted on the welded areas.

D. Perimeter fencing chain link fabric shall be fastened to the outside of the fence.

E. All fabric shall be stretched and securely fastened to the posts, as follows:

F. The fabric shall be fastened to end, corner and gate posts with 3/16 inch by 5/8 inch stretcher bars and not less than 1/8 inch by 3/4 inch stretcher bar bands spaced at one foot intervals for whatever widths of fabric are supplied. The fabric shall be fastened to line posts with tie wires or post clips. Tie wires shall be at least 9-gauge (0.148 inch diameter) steel. Post clips shall be at least 6-gauge (0.192 inch diameter) steel. The wire or clip fasteners shall be spaced at approximately 14 inches on line posts, with a minimum of 5 fasteners per 6 foot high post. Top and bottom edges of the fabric shall be secured to each horizontal brace with tie wires or fastened to tension wire with hog rings spaced at 15 inch maximum intervals. Hog rings shall be at least 9-gauge (0.148 inch diameter) steel. Wire ties shall be given at least one complete turn. Hog rings shall be closed with ends overlapping. The distance from the selvage to the braces or

top rails shall be 2 inch maximum and shall be fastened to the brace or rail by wire fasteners spaced at approximately 14 inches with a minimum of 8 fasteners per each 10 foot horizontal span.

G. Construct concrete mowstrip at the width as shown on the plans.

END OF SECTION

SECTION 32 31 19
ORNAMENTAL METAL FENCES AND GATES

PART 1 -GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, equipment, and services necessary to completely install all Ornamental Metal materials, accessories, and other related items necessary to complete the Project as indicated by the Contract Documents.

2. Related Sections: The following Project Manual Sections contain requirements that relate to this section:

a. Drawings and general provisions of contract

b. 32 13 13Site Concrete Improvements

c. 31 20 00Earthwork

d. 32 31 11 Gate Operators

1.2 REFERENCES

A. Standards:

1. In accordance with the following standards:

a. ASTM: American Society of Testing Materials

b. AWS: American Welding Society

c. NAAMM: National Association Of Architectural Metal Manufacturers

d. NFPA: National Fire Protection Association

e. UL: Underwriters laboratories

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.

1. Gate system: engineer gate system according to opening width.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s information for each type of product indicated.

B. Shop Drawings.

1. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.

2. Layout of fence and gates with dimensions, details, and finishes of component accessories and post foundations and gate operators and mechanical arms

C. Quality Assurance/Control Submittals:

1. Manufacturer's Written Instructions for installation

D. Closeout Submittals in accordance with the following:

1. Maintenance Data in accordance with Division 01 Specification Sections

2. For gate operators to include in maintenance manuals.

3. Operation Data in accordance with Division 01 Specification Sections

4. Record Documents in accordance with Division 01 Specification Sections

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

b. Manufacturer/Supplier Qualifications:

1) Firm experienced in successfully producing/supplying steel ornamental picket fence systems, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

2. Regulatory Requirements:

a. In accordance with Specification Section - Regulatory Requirements, and the following:

1) CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB)and the Environmental Protection Agency (EPA), in the area where the project is located.

2) Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for operators on gates that must provide emergency access.

1.6 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

1.7 OWNER'S INSTRUCTIONS

A. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below:

1. Test and adjust controls and any safeties. Replace damaged or malfunctioning controls and equipment.

a. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.

1.8 WARRANTY

A. Contractor's General Warranty:

1. Warranty Period: One (1) Year

2. Manufacturer's Warranty:

a. In accordance with manufacturer's written standard warranty that includes language indicating the products will be free from cracking, peeling, blistering and corroding as indicated for the Warranty Period:

b. Warranty Period: Twenty (20) Years.

3. Installer's Warranty:

a. Warranty period: One (1) Year.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

A. These products listed herein establish the size, pattern, color range and function selected by the Engineer for this project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

B. Ornamental Metal Fence & Swing Gates

1. Manufacturer: Ameristar Montage Industrial Fence

2. Style: Genesis 3 Rail

3. Bottom Rail Treatment: Extended Picket

4. Nominal Height: 6 feet

5. Nominal Width: 8 feet

C. Ornamental Metal Roll Gate System:

1. Manufacturer: Ameristar Passport II Industrial

2. Style: Genesis 3 Rail

2.2 MATERIAL

A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (344 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft2 (184 g/m2), Coating Designation G-60.

B. Material for pickets shall be 1” square x 16 Ga. tubing. The rails shall be steel channel, 1.75” x 1. 75” x .105”. Picket holes in the rail shall be spaced 4.715” o.c. Fence posts and gate posts shall meet the minimum size requirements of Tables 1.1 and 1.2, respectively.

Table 1 - Minimum Fence Post Sizes	
Panel Height	Fence Post Size
Up to and Including 6'	2-1/2” x 14 Ga.
Over 6' Up to and Including 8'	2-1/2” x 12 Ga.
Table 1.2 - Minimum Gate Post Sizes	
Gate Leaf	Gate Height

Table 1.2 - Minimum Gate Post Sizes			
	Up to & Including 4'	Over 4' Up to & Including 6'	Over 6' Up to & Including 8'
Up to 4’	2-1/2” x 12 Ga.	3” x 12 Ga.	3” x 12 Ga.
4’1” to 6’	3” x 12Ga.	4” x 11 Ga.	4” x 11 Ga.
6’1” to 8’	3” x 12 Ga.	4” x 11 Ga.	6” x 3/16”
8’1” to 10’	4” x 11 Ga.	6” x 3/16”	6” x 3/16”
10’1” to 12’	4” x 11 Ga.	6” x 3/16”	6” x 3/16”
12’1” to 14’	4” x 11 Ga.	6” x 3/16”	6” x 3/16”
14’1” to 16’	6” x 3/16”	6” x 3/16”	6” x 3/16”

C. The manufactured panels and posts shall be subjected to an inline electrodeposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash, followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).

Table 2 - Coating Performance Requirements		
Quality Characteristics	ASTM Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8” coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625” ball).
Weathering Resistance	D822 D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

E. Completed roll gates shall be capable of supporting a 200 lb. load applied at midspan without permanent deformation.

2.3 GATES

A. Accessible Pedestiran Swing Gates

1. Handles, pulls, latches, locks and other operable parts on gates shall comply with CBC Section 11B-404.2.27 and 11B-309.4

2. Gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

3. Gates shall have a minimum 10 inch high steel bottom kick plates on both sides of gate. Cavities created by kick plates shall be capped.

4. Hardware

a. Passage Non-Keyed Gate Latch: Schlage ND Series, Rhodes Lever or approved equal

b. Panic Exit Device: Von Duprin AX98 Rim Exit Device with Hex Key Dogging

1) Gates along the security perimeter shall have vandal resistant trim. Von Duprin VR914 grip or approved equal

2) Interior gates shall have a lever trim keyed to the District's specifications. Schlage ND Series, Rhodes Lever or approved equal

c. Self Closing Hinges Hinges: Locinox Mammoth 180

d. Gate Holdback: Trimco 1209HOHA-626

e. Fire Access: As required by local fire authority

B. Non- Accessible Swing Gates

1. Hardware

a. Latch: Lockable latch per manufacturer

b. Hinges: Weld-on box hinge per manufacturer

c. Gate Holdback: Trimco 1209HOHA-626

C. Roll Gates

1. Hardware per gate manufacturer

2. Fire Access: As required by local fire authority

3. Motorized Gate Operator: Refer to spec section 32 31 11 GATE OPERATORS

2.4 MISCELLANEOUS MATERIALS

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

B. Concrete: Coordinate with Specification Section – SITE CONCRETE IMPROVEMENTS.

C. Non-shrink Grout: Coordinate with Specification Section – SITE CONCRETE IMPROVEMENTS.

D. Expanded Metal

PART 3 -EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which, affect the execution of work under this specification section.

2. Report unacceptable conditions to the Engineer. Do not begin work until unacceptable conditions have been corrected.

3. Execution of work under this specification section shall constitute acceptance of existing conditions.

3.2 PREPARATION

A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

2. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3. Protection:

a. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

4. Surface preparation:

    a. Prepare surface in accordance with manufacturer's written instructions and recommendations.

3.3 INSTALLATION

A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.

2. In accordance with approved submittals.

3. In accordance with Regulatory Requirements.

4. Set plumb, level, and square.

5. Layout:

    a. Lines shall be straight and true.

6. Fence Panel Installation:

    a. Install fence in accordance with manufacturer’s written instructions.

    b. Space posts uniformly at 8’-0” maximum o.c. unless otherwise indicated.

    c. Concrete Set Posts:

        1) Drill hole in firm, undisturbed or compacted soil.

        2) Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.

        3) Place concrete around post in a continuous pour.

        4) Vibrate or tamp for consolidation.

        5) Protect aboveground portion of posts from concrete splatter.

        6) Trowel finish around posts and slope to direct water away from posts.

        7) Gate Posts and Hardware: Set keepers, stops, sleeves and other accessories into concrete.

    d. Check each post for vertical and top alignment and maintain in position during placement and finishing operation

    e. Align fence panels between posts. Firmly attach rail brackets to posts with ¼” bolt and lock nut. Rivet top to bracket to assure security.

7. Gate Installation

    a. Install gates plumb, level and secure for full opening without interference.

    b. Attach hardware by means, which will prevent unauthorized removal.

    c. Adjust hardware for smooth operation.

8. Gate motors

    a. Install gate motors per the details in the project plans and per the manufacturer's recommendations

    b. Fill any voids or gaps between the bottom of the motor and the concrete pad with non-shrink grout so that all voids are filled completely.

9. Entry Control Pedestals

    a. Install entry control pedestals per the details in the project plans and per the manufacturer's recommendations

    b. Fill any voids or gaps between the bottom of the pedestal baseplate and the concrete footing with non-shrink grout so that all voids are filled completely.

3.4 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

C. Commission operable gates and complete witness testing in the presence of the owner's representative and the Engineer or Record to verify proper function of operators, entrapment protection, and entry pedestal equipment.

END OF SECTION

SECTION 32 33 10
TACTILE/DETECTABLE WARNING SURFACE TILE

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 SECTION INCLUDES

A. Tactile/Detectable Warning Surface Tile where indicated.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two tile samples minimum, 6 inch by 8 inch of kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on Surface Applied tactile tile system as certified by a qualified independent testing laboratory.

E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

1.4 QUALITY ASSURANCE

A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.

B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces that comply with detectable warnings on walking surfaces section of Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.

D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of “Detectable Warning”. Section 11B-406 for “Curb ramps, blended transitions and islands” and Section 11B-705 for “Detectable warnings and detectable directional texture”.

E. Detectable Warning Texture: Division of the State Architect (DSA Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1, IRs 11B-2, 11B-3 and 11B-4 and the California Accessibility Reference Manual.

1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.9 inch at base tapering to 0.45 inch at top, height of 0.2 inch, with center-to-center spacing of 2.35 inches and corner domes spaced at 0.896 inch from the corner edges of tile. Provide raised truncated domes in a square grid (in-line) pattern.

a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

1.5 DELIVERY, STORAGE AND HANDLING

A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.

B. Tiles shall be delivered to location at building site for storage prior to installation.

1.6 SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.

C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.

D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

1.7 EXTRA STOCK

A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) percent of the supplied materials for each type, color and pattern installed.

1.8 WARRANTY (DETECTABLE WARNINGS AND DIRECTIONAL TEXTURE)

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detectable warnings and directional surface products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.

b. Degrade significantly means that product maintains at least 90 percent of its approved design characteristics, as determined by the authority having jurisdiction.

2. Warranty Period: Five years from date of Final Completion.

3. Authority: California Building Code Section 11B, Division of the State Architect Interpretation of Regulations (IR) 11 B-2, 11B-3 11B-4.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Engineered Plastics Inc., Armor Tile.

2. ADA Solutions, Inc., North Billerica, MA.

B. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1, IRs 11B-2, 118-3 and 11B-4 and the California Accessibility Reference Manual.

1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.9 inch at base tapering to 0.45 inch at top, height of 0.2 inch, with center-to-center spacing of 2.35 inches and corner domes spaced at 0.896 inch from the corner edges of tile; Provide raised truncated domes in a square grid (in-line) pattern.

a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

2. Detectable Warning Texture (Truncated Domes): Plastics/Composites: Armor Tile, ADA Tactile Systems by Engineered Plastics Inc., North Billerica, or equal.

C. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

D. Color: Yellow conforming to Color No. 33538 of SAE AMS-STD-595A. Color shall be homogeneous throughout the tile.

2.2 MATERIALS

A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: W diameter x 1 3/4” long, or manufacturer’s recommended fasteners.

B. Adhesive and Sealant: Manufacturer’s recommended adhesive and sealant.

PART 3 EXECUTION

3.1 INSTALLATION

A. Surface Applied: The following installation instructions shall be used for tactile warning tiles installed at existing concrete surfaces.

1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.

3. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Engineer.

4. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. Use thin permanent marker. Remove tile when done marking its location.

5. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.

6. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for minimum of 30 days.

7. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.

8. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2” width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.

9. Set the tile true and square to the curb ramp area as detailed in the design drawings.

10. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3W using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.

11. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.

12. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.

13. Working in a sequence that will prevent buckles in the tile, proceed to drill and install all fasteners in the tile’s molded recesses.

14. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer’s recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent

concrete back 1/2” from the tile’s perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.

15. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.

16. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.

17. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.

18. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each. If tiles are custom cut to size, and if pre-molded recesses (to receive fasteners) are removed by the cut, then any truncated dome can be center-drilled with a 5 inch through hole, and countersunk with a suitable bit, to receive mechanical fasteners. New holes should be created no closer to the edge of the tile than any of the other perimeter fastener pre-molded recesses. Care should be taken to not countersink too deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.

19. Adhesive or caulking on the surface of the Tile can be removed with Acetone.

B. Wet Set: The following installation instructions shall be used for tactile warning tiles installed at new concrete surfaces.

1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.

3. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Engineer.

4. Set the tile true and square to the curb ramp area as detailed in the design drawings.

5. Immediately prior to installing the detectable warning surface tile, the wet concrete surfaces must be inspected to ensure that it is clean and free of debris.

6. Do not remove protective plastic covering on detectable warning tile product until tile is installed and concrete is fully cured.

7. Slowly press the detectable warning tile into the wet concrete until the base of the truncated domes is flush with the adjacent concrete. Do not stand on the tile during installation. Tap the detectable tile with a rubber mallet as required to ensure all edges are flush with concrete. Install anchors into wet concrete as specified per manufacturer's recommendation and ensure that the anchors are flushed with the detectable tile surface. Provide weight to the detectable tile surface if "floating" occurs after tile placement. All detectable tile edges shall be flush with adjacent concrete.

8. While the concrete is workable, a 1/8" deep troweled edge shall be installed around the tile perimeter. Finish the concrete as required per specifications. Ensure concrete edge do not have any low areas that collect water.

9. Set the tile true and square to the curb ramp area as detailed in the design drawings.

10. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.

11. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.

12. Remove protective plastic sheeting after all post-installation treatments are complete and the concrete has cured.

3.2 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by methods recommended by manufacturer.

END OF SECTION

SECTION 328400 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to furnish, install and maintain the Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. Related Work Specified Elsewhere
   1. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to work of this section.
   2. Section 31 20 00 – Earthwork
   3. Section 31 23 00 – Trench Excavation and Backfilling
   4. Section 32 90 00 – Landscape Planting
   5. Division 26 00 00 – General Electrical

1.02 CODES AND REGULATIONS

A. All work and materials shall be in full accordance with the following codes adopted and amended by the authority having jurisdiction. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. The work described in these specifications shall govern in the event that the drawings or specifications call for material or methods of construction of higher quality or standard than required by these codes.
   1. California Plumbing Code
   2. California Administrative Codes:
      a. Title 8, Industrial Relations
      b. Title 19, Public Safety
   3. California Electrical Code
   4. California Green Building Standards Code, Section 5.304.
   5. California Department of Water Resources, Model Water Efficient Landscape Ordinance (MWELO)
   6. Standards and Regulations of other agencies, water utility provider, or organizations as listed in this specification relating to products or procedures, e.g. American Society for Testing and Materials.

1.03 DEFINITIONS

A. Piping: All pipe fittings, valves, and accessories as required for a complete irrigation system.

B. PVC: Polyvinyl Chloride.

C. Agencies and Organizations:
   1. ASTM- American Society for Testing and Materials
   2. AWWA- American Water Works Association
   3. IAPMO- International Association of Plumbing and Mechanical Officials

4. CEC - California Electrical Code
5. UL - Underwriter's Laboratories
6. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.

D. Owner: An authorized representative of the Owner or the Owner's authorized consultant.

1.04 QUALITY ASSURANCE

A. The work of this section shall be performed by a single firm experienced in irrigation work and holding a current California Contractor's A or C27 License.

B. Qualifications of Workers
1. The Contractor shall employ skilled workers who are thoroughly trained and experienced in irrigation system installation and who are completely familiar with the specified requirements and methods needed for proper performance of this work.
2. The Contractor shall provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.

1.05 SUBMITTALS

A. An operational assessment report of any existing irrigation system in the area of work shall be submitted prior to the start of the project's work, including demolition and clearing. See Subsection 1.07.

B. The Contractor shall submit complete lists of proposed materials and equipment per the Division 01 Submittal Section, including manufacturer's name and model numbers. Only provide additional product data and/or catalog cut sheets if a substitute material or equipment is proposed. No substitution will be allowed without prior written approval.

C. Shop drawings shall be provided for the layout and description of all equipment assemblies, including dimensions, capacities, and other characteristics as listed in product specifications. Shop drawings for booster pump assemblies shall clearly and neatly indicate the layout of the assemblies and proposed piping in the pump yard, and shall show adjacent equipment, required clearances, walls, fences, piping and other existing permanent improvements affecting the layout. Materials and equipment shall not be ordered until given written acceptance. Equipment or materials installed or furnished without prior approval or acceptance may be rejected and the Contractor shall be required to remove such materials from the site at his own expense.

D. When specific name brands of equipment and materials are used, they are intended as preferred standards only. This does not imply any right upon the part of the Contractor to furnish other materials unless specifically approved in writing as equal in quality and performance by the Owner. Decisions by the Architect/Engineer shall govern as to what name brands of equipment and materials are equal to those specified on the plans and his decisions shall be final. It shall be the responsibility of the Contractor to furnish proof as to equality of any proposed equipment or material.

E. Approval of any item, alternate or substitute indicates only that the products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

F. Acceptance of any submittals, deliverables, or other work product of the Contractor shall not be construed as assent that the Contractor has complied with, nor in any way relieved the Contractor of compliance with (i) the applicable standard of care, and/or (ii) applicable statutes, regulations, rules, guidelines, and contract requirements.

G. Irrigation Equipment: When the Contractor desires to transfer salvaged irrigation equipment and/or new spare equipment and/or parts to the Owner, he must submit along with the equipment an itemized list. The Contractor is solely responsible to obtain a written confirmation by the Owner that all materials received by the Owner matches his material list. The transfer of materials will not be considered executed without written confirmation of same.

H. Submit any required or requested testing data and/or Certificates, including but not limited to the backflow prevention assembly testing Certificate after the assembly is installed prior to regular system operation.

1.06 EXPLANATION OF DRAWINGS

A. The intent of the drawings and specifications is to indicate and specify a complete and efficient sprinkler irrigation system ready for use in accordance with the manufacturer's recommendations, and all applicable local codes and ordinances. Interpretation of irrigation plans and specifications shall be the responsibility of the Landscape Architect or Owner.

B. All existing systems and improvements are shown in their approximate locations. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and shall report any variations to the Owner.

C. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his work, and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between sprinkler systems, planting, utilities, and architectural features will be avoided. Locate pipe, valves and other equipment in planting areas unless specifically noted otherwise.

D. All work called for on the drawings by notes shall be furnished and installed whether or not specifically mentioned in the specifications.

1.07 EXISTING CONDITIONS

A. The Contractor shall not install the irrigation system and equipment as shown on the Drawings when it is obvious in the field that obstructions or differences in existing

conditions and/or systems are present. Such obstructions or differences should be immediately brought to the attention of the Owner. Failure to provide notification prior to the start of this work shall make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage of the system without any additional cost to the Owner.

B. The Contractor shall examine carefully the site of work contemplated and the proposal, plans, specifications, and all other contract documents. By submitting a bid, the Contractor attests that he has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantity of work to be performed and materials to be furnished, and the requirements of the specifications. The Contractor shall take necessary precautions to protect existing site conditions that are to remain. Should damage be incurred, the Contractor shall make the necessary repair or replacement to bring it back to its original condition at his own expense.

C. Prior to cutting into the soil, the Contractor shall coordinate with the Owner to locate all cables, conduits, sewers, septic tanks, and other such underground utilities as are commonly encountered and he shall take proper precaution not to damage or disturb such improvements. If a conflict exists between such obstacles, notify the Owner who will consider realignment of the proposed work. The Contractor will proceed in the same manner if a rock layer or any other condition encountered underground makes change advisable. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown in plans.

D. The Contractor shall verify the correctness of all finish grades within the work area in order to insure the proper soil coverage (as specified) of the sprinkler system pipes. The Contractor shall verify and be familiar with location and size of the proposed water supply (P.O.C.). He shall make approved type connection and install new work.

E. The Contractor shall be responsible for notifying the Owner prior to installation that equipment or methods indicated on the drawings or in the specifications conflict with local codes, are incompatible or an error is apparent. It the event the Contractor neglects to do this, he will accept full responsibility for any revisions necessary.

1.08 PERMITS

A. The Contractor shall obtain and pay required fees to any governmental or public agency. Any permits for the installation or construction of any of the work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. He shall also arrange for and pay all costs in connection with any inspections and examination required by these authorities.

1.09 TESTING

A. General: Unless otherwise directed, tests shall be witnessed by the Owner. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered 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 re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

B. Main Line Piping: Hydrostatically test main line pipe segments after a minimum of twenty-four (24) hours after any solvent connections. Purge any free air in the test pipe sections. Partially backfill pipe but keep all joints exposed. Maintain 125 psi water pressure in new main line piping for a minimum duration of two (2) hours. There can be a maximum +/- 5psi change in pressure during the test.

C. After being installed at the project site, any newly installed Backflow Prevention unit must be tested and approved as functioning properly per the local water agency requirements. Approval of the backflow prevention unit must precede any final inspection of the irrigation system. All costs for testing shall be the responsibility of the Contractor.

1.10 OBSERVATION

A. General:

1. Installation and operations must be approved by the Owner.
2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.
3. In all cases, where inspection/observation of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or review of the Owner, including but not limited to the review items in the Irrigation plan Observation Log, the Contractor shall notify the Owner at least 72 hours in advance of the time when such review and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to provide the required notification and/or to obtain the review/observation, shall be performed at the Contractor's own expense.

B. Periodic observations shall be required for basic operations and installations during progression of the project. The Owner, or Project Inspector shall perform the observations and shall record the observation on the Irrigation System Observation Log form on the As Built Record Drawings. Such observations will include but not necessarily be limited to the following items as included in the scope of work:

1. Layout and flagging of sprinkler heads.
2. Trenching.
3. Main line installation.
4. Main line sustained pressure check.
5. Wire placement.
6. Partial fill compaction of trenches.
7. Control valve installation.
8. Drip line installation prior to backfilling.

9. Irrigation controller installation and operation.
10. Backflow Prevention Assembly installation.
11. Sprinkler/emitter coverage prior to the start of planting operations.
12. Overall system operation and primary/secondary communication.

C. Coverage & Operations Review:
   1. When the irrigation system is operational and prior to soil conditioning operations, the Contractor in the presence of the Owner shall perform a coverage test of the irrigation system. The Contractor shall furnish all materials and labor required to perform the coverage test and to correct any minor inadequacies of coverage disclosed. The Contractor shall inform the Owner and Owner of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such notification of necessary corrections or additions to the irrigation system is not provided prior to or during the coverage test, the Contractor shall make all subsequent adjustments and corrections needed for proper coverage without any extra cost to the Owner.
   2. Prior to the start of the maintenance period, the irrigation system shall be reviewed by the Owner for proper operations, and a review of and training on equipment and associated controls performed. Any corrections and/or adjustment shall be made as a condition for the start of the maintenance period and subsequent Final Acceptance.

D. Final Acceptance: The work will be accepted in writing when the entire project improvements have been completed to the satisfaction of the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary for the Owner to occupy any portion of the work area before the contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's separate work forces.

1.11 REJECTION OF NON-CONFORMING MATERIAL OR WORK

A. The Owner reserves the right to reject any material or work which does not conform to the contract documents. The rejected material or work shall be removed or corrected by the Contractor at no additional cost to the Owner.

1.12 OPERATIONS AND MAINTENANCE INSTRUCTIONS & RECORD DOCUMENTS

A. The Contractor shall prepare and deliver to the Owner’s Representative within ten (10) calendar days prior to completion of the maintenance period, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound sets of Operating and Maintenance Manuals. These manuals shall describe the material installed and shall be in sufficient depth to permit operating personnel to understand, operate and maintain all equipment. Spare part lists and related manufacturer identification shall be included for each installed equipment item. Each complete, bound manual shall contain the following information:
   1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of equipment, with names and addresses of local manufacturer representatives and warranty periods.

2. The Contractor to issue a "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions and that the system functions properly.
3. Complete operating and maintenance instructions and warranties on all major equipment.
4. Complete set of manufacturer's literature and specifications of material installed, including parts list.
5. A list of the controller station number for each control valve if different than the control valve number shown on the drawings.
6. Initial electrical data on each control valve:
   a. Ohms reading for each valve taken at the controller (circuit is OFF).
   b. Voltage reading for each valve taken both at the controller and at the valve (circuit is ON).

B. The contractor shall furnish one set of As-Built full-scale drawings on bond, and two compact disks with complete sets of digital PDF files of all close-out documents after the As-Built Record Drawings have been reviewed and accepted by the Landscape Architect.
   1. Label first page of each document, or set of documents, "AS-BUILT PROJECT RECORD" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Prints for this purpose may be obtained from the Owner. This set of drawings shall be kept on the site and shall be used only as a record set. Do not conceal any work until required information is recorded. These drawings shall also serve as work in progress sheets, and the Contractor shall make **neat and legible** annotations thereon daily as the work progresses, showing the work as actually installed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Owner.
   2. Drawings: Legibly mark to record actual construction:
      a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and depth of each concealed line or item. Accurately locate each capped, plugged or stubbed line.
      b. Field changes of dimension and detail.
      c. Changes made by Field Order, Addenda, or other change document.
      d. Show the final controller station number for each control valve if different than the control valve number shown on the drawings.
   3. Deliver all Close-out Documents (As-Builts) to the Owner. Accompany submittal with transmittal letter in duplicate, containing:
      a. Date.
      b. Project title.
      c. Contractor's name and address.
      d. Title and number of each Record Document (As-Built).
      e. Signature of Contractor or his authorized representative.

C. The Contractor shall provide controller chart(s) as follows:
   1. The Contractor shall provide two controller charts for each controller’s area of work.

2. The chart shall show the area of work controlled by the automatic controller and shall be the maximum size that the controller door will allow.
3. Show the controller station number for each control valve if different than the control valve number shown on the drawings.
4. The chart may be a reduced drawing of the actual as-built system. However, in the event the valve numbering is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
5. The chart shall be colored with a different permanent color for each station.
6. The chart shall be enclosed in a waterproof envelope or laminated.

D. Per MWELO Section 492.9, upon completion of the landscape planting and irrigation system, and as a condition of Final Acceptance and/or the issuance of a Certificate of Occupancy, the licensed landscape contractor shall submit to the approving agency and/or Owner, the following items in a form acceptable to the approving agency and/or Owner:
   1. Project information and contact information for the Owner and Applicant (Contractor).
   2. Certification that the installation complies with the approved Landscape Documentation Package.
   3. Irrigation scheduling parameters used in programming the controller during the establishment and maintenance periods.
   4. A Schedule of Irrigation System Maintenance.
   5. A Landscape Irrigation Audit Report per MWELO Section 492.12. Provide the Audit Report unless the report is not required by the approving agency or Owner.

1.13 SPARE PARTS AND EQUIPMENT

A. Prior to the conclusion of the maintenance period, furnish the Owner with the following spare parts and equipment:
   1. One quick coupler key with attached hose swivel for each set of four quick coupler valves installed.
   2. Ten spare nozzles for each different sprinkler head arc and/or radius nozzle installed.
   3. One valve key for the 2” operating nut and/or hand wheel isolation valve.
   4. One hundred feet of in-line emitter tubing with ten straight and ten ninety degree compression fittings.
   5. One functional Universal controller remote programmed to operate the system controllers.

1.14 WORK AREA AND SAFETY

A. The Contractor shall furnish, erect, and maintain all temporary facilities; perform all temporary work during the period of construction, including those herein specified. All facilities shall be maintained in proper and safe operating and sanitary conditions at all times.

B. The Contractor shall comply with the provisions of the Construction Safety Orders, and General Safety Orders issued by the State Division of Industrial Safety, as well as all other applicable laws, ordinances and regulations.

C. The project site shall be maintained in a neat and safe condition at all times. Cleanup shall be accomplished as the work progresses and upon completion of the

work. The Contractor shall provide adequate safety measures to protect workers and the public from injury.

1.15 GUARANTEE

A. Irrigation system consisting of materials, equipment and workmanship shall be guaranteed for proper operation a minimum of one year from date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later. Manufacturer's warranty periods may be longer, and shall be noted in the close-out documents.

B. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects of materials, equipment or workmanship one year from the date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later.

C. The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the Guarantee as herein specified.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Schedule rated white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1785.

B. Class rated (Standard Dimension Ratio) white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1784.

C. PVC pipe shall be of the Class or Schedule as follows:
   1. PVC pipe shall meet ASTM D-2241 for solvent weld, plain end, ASTM D-2672 for solvent weld, bell end, and ASTM D-3139 for gasketed bell end. Pipe shall be of the Schedule and/or Class as indicated herein.
   2. Pipe sleeves under paving shall be PVC Schedule 40 for 3-inch and smaller or SDR 35 for 4-inch and larger pipes.
   3. Riser and/or manifold pipe connecting valves to main line fittings shall be Schedule 80 PVC.
   4. Pressurized main line pipe shall be Schedule 40, belled end with solvent welds for pipe sizes less than 2 inches. Pipe sized 2 inches and greater shall be Class 200, SDR 21, with gasketed bell ends.
   5. Non-pressurized lateral line pipe shall be Schedule 40, belled end with solvent welds.

D. All pipes shall be continuously and permanently marked and conform with the following information: manufacturer's name or trademark, nominal pipe size, Schedule or Class of pipe, pressure rating in PSI, ASTM designation and (NSF) seal of approval.

E. Rigid polyvinyl chloride (PVC) Fittings:

1. White Schedule 40 type I and II grade 1, solvent weld socket fittings ASTM D-2466 for all lateral lines 2-1/2 inches and smaller.
2. Gray Schedule 80 type I and II grade 1 solvent weld socket fittings ASTM D-2464 for all main line less than 2 inches diameter, and lateral lines 3 inches and larger.
3. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable (IPS) schedule, and (NSF) seal of approval.
4. All plastic fittings and connectors shall be injection molded of an improved polyvinyl chloride compound featuring high tensile strength, high chemical resistance and high impact strength in terms of current ASTM standards for such fittings. Where threads are required in plastic fittings, these shall be injection molded also.

F. PVC Solvent Weld Adhesive: All socket and bell type connections shall be joined with primer and PVC solvent cement which shall meet the requirements of ASTM F656 for primer and ASTM D2564, "Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings." Solvent cement joints for plastic pipe and fittings will be made as prescribed by manufacturer. The high chemical resistance of the pipe and fitting compounds specified in the foregoing sections makes it mandatory that an aggressive colored primer, which is a true solvent for PVC be used in conjunction with a solvent cement designed for the fit of pipe and fittings specified. A heavy bodied, medium set solvent cement, e.g. Weld-On 711 gray, shall be used for all classes and schedules of pipe and fittings.

G. PVC Pipe Thread Sealant: A non-hardening all purpose sealant and lubricant similar to Permatex #51 or Lasco blue pipe thread sealant which is certified by the manufacturer to be harmless to PVC pipe and fittings. Apply sealant to clean male threads, brushing into grooves and to the first three threads of the female threads. A good quality grade of teflon tape recommended by the manufacturer for use with plastics may be used in lieu of sealant. Minimum width of tape to be used is 3/4". A minimum of two wraps and a maximum of three wraps shall be used.

H. PVC Swing Joints: Connections to sprinkler heads from lateral lines shall be made with swing joints as detailed. Pre-assembled swing joints from Hunter, King Brothers or Spears are acceptable.
   1. Use 6” length nipples for 1/2 inch inlet heads.
   2. Use 12” length nipples for 3/4 or 1 inch inlet heads.

I. Coated Ductile Iron pipe and fittings:
   1. Ductile Iron pipe shall be centrifugally cast pipe conforming to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.
   2. Ductile Iron flanged pipe shall conform to ANSI/AWWA C115/21.15.
   3. Ductile Iron flanged fitting to PVC pipe shall use a ‘Megalug’ mechanical joint restraint Series 2000PV by EBAA Iron per either ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53, or equal.
   4. Joints shall comply with the following standards:
      a. Rubber gasketed/mechanical joints: ANSI/AWWA C111/A21.11.
      b. Flanged joints: ANSI/AWWA C110/A21.10, B16.1, B16.2.

J. Coated ductile iron push-on fittings meeting ANSI/AWWA C110 or C153/A21.10 shall be used for:

1. Main line connections for pipe 2 inches and greater in diameter.
2. New main line service tee at valve connections where a service saddle is not acceptable.
3. Self-restrainted fittings or joint restraints (Leemco LH or equal) shall be used for all elbows, tees, bends, etc fittings.

K. Coated ductile iron service saddles with stainless steel double straps, Smith-Blair 317, Romac Industries 202NS, or equal, shall be used for remote control/quick coupler valve service connections on main lines 1.25 inch or greater, and where the available outlet size can match the largest lateral line size downstream of the remote control valve.

L. Galvanized pipe and fittings:
1. Galvanized Pipe shall be hot dip galvanized continuous welded, seamless steel SCH 40 pipe conforming to current ASTM A53 standards.
2. Galvanized Fittings shall be galvanized, threaded malleable iron SCH 40 conforming to current ASTM A865 standards.

2.02 BACKFLOW PREVENTION ASSEMBLY

A. Backflow prevention assembly shall be a reduced pressure principle type with resilient seated shut off valves as shown on the Drawings. The backflow preventer shall be approved by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research.

B. Provide a commercial anti-freeze insulated blanket around the backflow assembly, FrostGuard by BPDI or equivalent. Wrap with minimum half-laps all above grade pipe with insulated tape rated for exterior use.

2.03 VALVES

A. Electric Control Valves:
1. Globe valves operated by low-power solenoid, normally closed, manual flow adjustment. Sizes and types as shown on drawings.
2. Provide a pressure regulating module on all control valves, or other pressure regulating components as part of the operating spray head or low volume head zones when the dynamic system pressure is, or may be greater than 45 psi.

B. Electric Master Valves:
1. Master valve shall be the brand and model as noted on the Drawings.

C. Control Valve Marking: Christy's valve identification tag (or equal), yellow color (purple color for recycled water) with text designating controller and valve station number, e.g. "A12", or equivalent.

D. Isolation Valves:
1. Cast bronze, coated ductile iron or coated cast iron gate valve with resilient wedge, non-rising stem and two inch operating nut for main line 2 inch size or greater. Match size of mainline.
2. Cast bronze threaded gate valve with bronze cross handle for main line less than 2 inch size.

E. Quick Coupling Valve: Two piece quick coupling valve as shown on the Drawings.

2.04 VALVE BOXES

A. Control Valve/Master Valve/Flow Sensor boxes:
   1. Shrub/Ground Cover areas: Carson 1419 body with lockable tan plastic cover, or equivalent. Drip Valve Kits shall use a Jumbo body with lockable tan plastic cover.
   2. Turfgrass areas: Carson 1419 body with lockable green plastic cover, or equivalent.
   3. Hardscape areas: Christy B16 concrete box (11.75” x 22.25”) with N16R composite solid flush lid, or equivalent.

B. Quick Coupler Valve boxes:
   1. Shrub/Ground Cover areas: Carson 910 body with lockable tan plastic cover, or equivalent.
   2. Turfgrass area: Carson 910 body with lockable green plastic cover, or equivalent.
   3. Skinned ballfield areas: Christy F08 round concrete valve box (8” ID) with F08R concrete lid, or equivalent. Boxes in a sports venue’s field of play that are noted to be installed below grade shall use a metal lid with a non-woven geotextile of a minimum 0.5 lb./sq. yd. covering the lid and box frame.

C. Isolation Valve boxes:
   1. Gate Valve box in hardscape: Christy G05 round concrete valve box (10.375” ID) with cast iron G05C lid, or equivalent.
   2. Gate Valve box in planting areas: Christy F08 round concrete valve box (8” ID) with F08R concrete lid, or equivalent. Use F14 ADS adapter and extension for sizes 2.5 inches and larger.
   3. Ball Valve box: Same as 2.04, A.

D. Control Valve box marking: Plastic lids shall have branded markings, and concrete lids shall have painted markings on the top of lid with minimum 2 inch high stenciled letters showing controller letter and station number.

2.05 CONTROLLER

A. Solid state microcomputer controller, completely automatic in operation, which shall electrically start the sprinkler cycle and program and time the individual stations. Controller shall have attached instruction booklet, integral 24V transformer, clock indicating time of day and day of week, 24V master valve circuit and terminal connection strip. Controller shall be universal remote ready with pre-installed receiver. See Drawings for manufacturer and model.

B. Controller enclosure shall be of a size and type as specified on the Drawings.

C. Upgrade components, sensors, flow meters and other accessories shall be a model type compatible with the controller and as specified on the Drawings. Controller assembly shall include boards and/or connections for sensor inputs. Weather sensors shall be located over a planting area.

D. Grounding materials shall conform to ASIC Guideline 100-2002 and manufacturer's specifications.

2.06 UNIVERSAL HANDHELD REMOTE

A. Remote unit shall be able to have complete control over any solid state or electro/mechanical controllers. Unit shall have a minimum range of one mile from transmitter to the receiver.

B. Remote unit shall be capable of coded FM transmissions which eliminate unwanted interference and works amid buildings or hilly terrain.

C. Receiver board shall be integral to the controller unit. The receiver antenna shall be integrated into the controller enclosure.

2.07 CONTROL AND TRACER WIRE, COMMUNICATION CABLE

A. Connections between the automatic controllers and the electric control valves, and tracer wire shall be made with direct burial AWG – UF 600 volt copper wire manufactured for irrigation system use.

B. Hot control wires for the first controller shall be red. If multiple controllers are installed, the hot wire color shall be orange, yellow, purple in order for each controller. Common ground wire shall be white, with a color stripe corresponding to the hot control wire color when multiple controllers are installed. Spare control wires shall be black and spare common wire blue. Tracer wire shall be green.

C. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall wire size be less than #14. Common wire shall be a minimum #12 size.

D. All control wire splices/caps shall be made with direct bury rated, waterproof wire connectors with silicone sealant, Spears DS-500 Dri-Splice, 3M DBR/DBY or approved equal. Use one splice per connector sealing pack.

E. Apply waterproof numbered wire markers or sleeves at both sides of all splices and at the controller terminal board corresponding to the controller (A, B, etc.) and station number (02, 14, etc.). If multiple valves are connected to one station, add a single digit indentifier (1, 2, etc.) to the station number (XX), e.g. A02-1, A02-2, etc.

F. Communication/flow sensor cable shall be a shielded and jacketed, minimum 16 gauge twisted pair with drain wire, Paige P7162D or equal compliant with the controller manufacturer's specifications.

G. Below-grade conduit for control wires and/or cables shall be PVC for electrical use with long radius sweeps at direction changes and at valve/splice/pull box terminations.

H. All two-wire control cable splices shall be made with direct bury rated, waterproof wire connectors with silicone sealant, 3M DBY-6 or approved equal. Use one splice per connector sealing pack.

I. Control two-wire cable shall be jacketed two wire system type, minimum 14 gauge twisted pair, IDWIRE1 or equal per controller manufacturer's specifications. Use different colored jackets for each wire branch. Wire branch splices shall be made with a Paige DCFD splitter.

J. Decoders shall be two-wire type manufactured by the controller manufacture. Use multiple station decoders at control valve banks wherever possible.

K. Use grounding products and materials at designated decoders and locations per the manufacture's specifications and ASIC Guideline 100-2002.

2.08 IRRIGATION HEADS

A. Spray/Bubbler Pop-up Head: Molded plastic body with pop-up plastic riser and nozzle. Manufacturer's model numbers are listed with description on the Drawings.

B. Rotor Pop-up Head: Molded plastic body with plastic riser and nozzle. Gear driven rotation with memory arc, balanced nozzle sets. Manufacturer's model numbers are listed with description on the Drawings.

2.09 DRIP IRRIGATION EQUIPMENT

A. Flexible distribution tubing shall be 0.66" – 0.70" OD (17mm nominal) fabricated from virgin polyethylene resin specifically designed for subsurface drip irrigation use and conforming to ASTM D 1248 for Type I, Class C, Category 4 Grade P14, and to ASTM D-3350 for PE 122111C. Provide all fittings, connectors and accessories compliant with the tubing for a complete, properly functioning system.

B. Pressure rating of tubing shall be as defined in Standard ASAE S435. Burst strength shall be minimum 50 psi at 176 degrees F for 4,200 hours.

C. In-line wye filters shall be type as noted on the Drawings. Filter element shall be molded polyester screen cylinder with minimum 150 mesh screen (blue).

D. Preset pressure regulators shall be type as noted on the Drawings for above or below ground application.

E. In-line emitter tubing shall be a below grade product with self-cleaning emitters. Manufacturer as noted on the Drawings.

F. Flush valve assembly as noted on the Drawings.

G. Operation indicator shall be a 6 inch pop-up sprinkler body with built-in check valve. Install a bubbler or variable arc nozzle that can be adjusted to a no-flow condition, Hunter ECO-INDICATOR, or equal.

2.10 CONCRETE

A. Cast-in-place Portland cement concrete used for pipe encasement, cover, thrust blocks, pipe support or other below-grade use shall at minimum comply with 2,800 psi 28 day strength.

2.11 OTHER MATERIALS

A. Materials not specifically indicated but necessary for the proper execution of this work shall be of first quality as selected by the Contractor subject to the acceptance of the Owner.

B. All materials appearing in the legend and details of the irrigation drawings are to be furnished and installed by the Contractor unless specifically noted to the contrary. Contractor is responsible for installation according to plans and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

C. Granular bedding material shall be clean natural occurring sand, free from clay, salt, sea shells or organic material, suitable for the purpose intended, and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve.

PART 3 - EXECUTION

3.01 SYSTEM DESIGN AND VERIFICATION

A. Contractor shall verify existing pressure and any existing irrigation equipment, and shall inform the Owner of any discrepancies between the exsiting systems' make and model of equipment, such as sprinkler heads, control valves, etc., and those indicated in the Drawings in writing prior to the start of irrigation system installation. Failure to inform the Owner of any discrepancy within seven working days prior to beginning of system installation will place the responsibility of any and all corrective action on the Contractor at no expense to the Owner.

3.02 PIPING INSTALLATION

A. General:
   1. Any equipment installed by the Contractor and deemed to be for the use of the Owner in various situations (i.e., control valves, control panels, etc.) shall be so installed to be readily accessible and quickly operable. Equipment deemed by the Owner to be inoperable for its intended purpose shall be reinstalled by the Contractor in an operable position before approval will be given. Any changes made by the Contractor shall be done without any additional cost to the Owner.
   2. The Contractor shall be responsible for layout of proposed facilities and any minor adjustments required due to differences between existing conditions and the Drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional costs to the Owner. The Owner will indicate the proposed precise location of the control panels. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Where head spacing is not specifically noted, Contractor shall install sprinkler heads evenly along the irrigation area's perimeter. Flush all lines prior to installation of heads.
   3. Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance to manufacturer's recommendations to allow for expansion. Lay on solid bedding, at uniform depth.

B. The Contractor shall examine all other portions of working drawings and plan trenching and pipe layout so that no conflict will arise between irrigation and any other work. Any corrective action will be the Contractors responsibility at no further expense to the Owner.

C. Excavations:
   1. Excavations shall be open vertical construction, sufficiently wide to provide clear working space around the work installed and to provide ample space for backfilling and tamping.
   2. The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the Owner. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Owner and Owner. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location does not allow the use of plowing at another location. Approval for plowing must be obtained for each location where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Owner, plowing shall be terminated.
   3. Trenches for pipe and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the line.
   4. Unless written approval for using native soils as bedding material is given by the Owner, main line pipe shall be placed on a minimum 6 inch depth of granular bedding material.
   5. Excess trench soil with rocks greater than ½ inch diameter shall be removed from the planted area and spread as directed by the Owner.
   6. When two pipes/conduit are to be placed in the same trench, it is required to maintain a minimum six inch (6”) horizontal separation between pipes/conduit.
   7. Depth of trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:
      a. 24-inch minimum over main lines and wire conduit.
      b. 18-inch minimum over non-pressure (rotary pop-up) lateral lines.
      c. 12-inch minimum over non-pressure (pop-up spray head) lateral lines.
      d. 24-inch minimum from subgrade over any lines located in a paved vehicle area.
      e. Maximum cover above the top of the pipe shall not exceed twelve inches (12”) greater than the required minimum cover.
      f. 12-inch minimum cover over drip line non-pressure lateral and manifold pipe, and main distribution tubing.
      g. 3-inch minimum cover over sub-surface rated in-line emitter tubing.
   8. Maximum cover above the top of the pipe shall not exceed twelve inches (12") greater than the required minimum cover, unless specifically noted on the drawings.

D. Assemblies:
   1. Routing of pressure supply lines as indicated on drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with details on plans.
   2. Install all assemblies specified herein according to the respective detail drawings or specifications pertaining to specific items required to complete the work. Perform work according to best standard practice.

3. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
4. All threaded pipe and fittings shall be assembled using an approved teflon tape, or equivalent, applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved teflon tape will be required.
5. No main line elbows, branch tees or isolation valves are to be located closer than five (5) feet to each other without prior approval of the Owner.

E. Line Clearance: All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Plastic to Steel Connections:
   1. At all plastic (PVC) pipe connections, the Contractor shall work the steel connections first. Connections shall always be plastic into steel, never steel into plastic. An approved teflon tape shall be used on all threaded (PVC) to steel, never steel into plastic. An approved teflon tape shall be used on all thread (PVC) to steel pipe joints applied to the male threads only, and light wrench pressure is to be applied. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved 3/4" wide teflon tape will be required.
   2. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

G. Plastic Pipe:
   1. The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under a weatherproof roofed structure before using and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point.
      a. All lumber, rubbish, rubble, concrete and rocks shall be removed from the trenches by the Contractor. Pipe shall have a firm uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking under riser tees shall be done only if specified on the plans. Pad trenches with soil as necessary to provide uniform bearing surfaces.
      b. Where extensive lengths of pipe are installed, snake pipe in trench from side to side to allow for expansion and contraction. One additional foot per one hundred (100) feet of pipe is the minimum allowance for snaking. Never lay pipe when there is water in the trench or when the temperature is 32 degrees F or below.
      c. All changes in direction of pipe shall be made with fittings, not by bending. No main line fittings for changes in direction shall be greater than 45 degrees. Provide a minimum five (5) feet between changes in direction fittings.
      d. Safely handle primers and cements per ASTM F-402. Make solvent weld joints per ASTM D-2855 with a non-synthetic bristle brush in the following sequence:
         1) Make sure pipe is cut square and all rough edges and burrs are removed. All connecting surfaces are properly cleaned and dry prior to application of pipe primer.
         2) Apply an even coat of colored primer to pipe and fitting prior to application of solvent.

3) Apply an even coat of solvent to the outside of the pipe, making sure that the coated area is equal to the depth of the fitting socket.
4) Apply an even light coat of solvent to the inside of the fitting.
5) Apply a second coat of solvent to the pipe.
6) Insert the pipe quickly into the fitting and turn pipe approximately one-eighth to one-quarter turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen seconds so the fittings do not push off the pipe.
7) Using a clean rag, make sure to wipe off all excess solvent to prevent weakening at joint.
8) Exercise care in going to the next joint so that pipe is not twisted, thereby disturbing the last completed joint.
9) Allow at least fifteen minutes setup time for each welded joint before moving.
10) Repairing plastic pipe when damaged shall be done by replacing the damaged portion of pipe.

H. Concrete Thrust Blocks: Concrete anchors or thrust blocks shall be provided on pressure main pipelines 2 inches or greater in diameter at abrupt changes in pipeline grade, changes in horizontal alignment (bends, tees and crosses), reduction in pipe size (reducers, reducing tees or crosses), end-line caps or plugs, and/or in-line isolation valve to absorb any axial thrust of the pipeline. The pipe manufacturer's recommendation for thrust control shall be followed. Thrust blocks must be formed against solid unexcavated earth (undisturbed). Do not enclose entire joint in concrete. Provide a minimum of three cubic feet of concrete for each thrust block.

I. Concrete thrust blocks may be eliminated if the main line piping system uses self-restrainted fittings and bell joint restraints per manufacture’s specifications throughout.

3.03 PIPE BACKFILL

A. Backfill shall not be placed until the installed system has been inspected, pressure tested and approved by the Owner.

B. Backfill for first 6 inches underneath, and 4 inches around and above main line pipe and control wires shall be granular bedding material, unless the Owner approves in writing that native soil may be used for initial backfill in lieu of granular bedding material. Backfill material for the upper portion of the trench shall be approved soil. Unsuitable martial, such as pipe remnants and wire including clods and rocks over two inches (2") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.

C. Backfilling for all pipe shall be carried out in two basic stages.
8. Stage One Backfilling: This shall be accomplished as soon as possible after the pipe is laid. A bedding of uniform depth with no voids must be provided along the entire length of the pipe. The bedding material should be placed in the trench and tamped into the areas under the pipe, using a suitable tool. Joints should be left exposed until hydrostatic tests are completed. Cover only those portions of the pipe necessary to prevent movement or damage.

9. Stage Two Backfilling: This shall be completed after all hydrostatic tests are completed and the piping system has been thoroughly checked for leaks or other defects. Continue to add backfill material in four inch (4") layers and hand tamp to achieve density similar to adjacent soil. After twelve inches (12") in main line trenches and eight inches (8") in lateral line trenches of hand tamped soil is in place over the pipe and fittings, backfilling can be continued, using light machinery to place dirt in the trenches in six inch (6") layers and to compact the dirt to conform to adjacent soil. Extreme care should be taken to avoid damage to the pipe from machinery that is too heavy. All trenches shall then be water jetted to assure uniform settling and compaction. Backfilling operations will not be considered complete until the top surface has been graded to conform to the adjacent soil. All rocks uncovered and not used as backfill must be collected and removed from the site.

D. All backfilling shall be done carefully and shall be properly tamped. All soil shall be tamped and puddled to eliminate any voids.

E. Surplus earth remaining after backfilling shall be disposed of as directed by the Owner.

F. PVC piping and fittings shall not be backfilled during periods of extreme heat or when a sudden lowering of temperature of the pipe may cause separation of joints or fittings.

G. Contractor shall fill with properly amended topsoil any irrigation trench that subsides during the warranty period. Contractor shall assume all cost associated with the trench repair, including but not limited to plant replacement of a size of plant disturbed at the time of the repair.

3.04 BACKFLOW PREVENTION ASSEMBLY

A. The backflow prevention assembly shall be installed by the utility subcontractor per the Contract Documents, manufacturer’s installation instructions, and agency requirements.

A. Install the backflow prevention assembly per the Contract Documents, manufacturer’s installation instructions, and agency requirements.

B. Install the freeze blanket per the manufacturer’s instructions.

C. Operational testing of any new backflow prevention assembly shall be performed by a Certified testing firm paid by the Contractor. Provide a Certificate of Operation satisfactory to the local agency.

3.05 CONTROL AND TRACER WIRE, AND COMMUNICATION CABLE

A. Do not tape wires together when encased in sleeve or conduit. Minimum cover shall be 24 inches. Crimp wires together at valve manifold with Scotchlok connector. Conventional valve wire splices shall use a 3M DBY splice kit. Tag all control wire at splices with approved control wire markers.

B. Wire size shall be determined by the number of valves operating on a given wire and the distance from the controller to the farthest valve, as specified by the charts furnished by the remote control valve manufacturer. Splices are only allowed when rerouting or repairing existing wire. All splice connections must be provided in a valve box.

C. Communication/sensor cable shall be installed in electrical conduit with long radius sweeps at direction changes and at valve/splice/pull boxes. Maintain a minimum six inch clearance to adjacent pipe. Minimum cover shall be 24 inches.

D. Install tracer wire along the top of pipe at the following locations:
   8. All pipe sleeves.
   9. Main line pipe without adjacent control wire.

E. All 2-wire splices/connections shall be made with a 3M DBY-6 direct bury splice kit in a valve box.

F. All 2-wire splices at cable branches shall be made with Paige Decoder Cable Fuse Device (DCFD) or equal. Control wire runs shall be continuous between main line branches. Branch splices shall be located in a valve box.

G. Install decoder grounding at locations and in a manner as required by the manufacturer's specifications and per ASIC Guideline 100-2002.

3.06 VALVES

A. The Contractor shall make all necessary connections for operation, and shall be connected and aligned to provide the most efficient flow of water to the irrigation heads. Where pressure regulating electric control valves are specified, the Contractor shall adjust the valve so a uniform distribution of water is applied by the heads, and that the most remote heads operate at the pressure recommended by the head manufacturer.

B. Each valve is to be enclosed in a separate valve box. The valve box shall be secured on firm soil clear of valves and wiring connections. Valve boxes and lids shall be set to finished grade or as indicated on the Drawings. Use valve box extensions of the same material as the box to the proper depth below the pipeline. Valve boxes shall be supported by common bricks at each corner and at the long side of the box. Use a minimum of six bricks to support rectangular boxes and four bricks to support round boxes. Backfill carefully and properly compact in order to prevent settlement and subsequent damage.

C. Install a concrete collar around valve boxes when located in asphaltic concrete pavement or in turfgrass areas.

D. Remote control valve boxes within the field of play at sports venues shall be buried with a minimum of 8 inches of cover over the box lid in turfgrass, and a minimum 3 inches in skinned infield or warning track surfacing.

E. When existing valve and/or splice boxes are within the area of work, replace in kind any damaged boxes and/or lids, unless noted otherwise. Adjust the elevation of all existing boxes within the area of work to final grade per the drawings.

F. Locate valve boxes in ground cover/shrub planting areas instead of turfgrass areas whenever possible. Locate valve boxes 18” from and perpendicular to adjacent paving. When grouped together, provide equal spacing of at least 36" between boxes.

G. Permanently attach the plastic valve identification tag to the remote control valve body and locate so it’s clearly visible in an open valve box.

H. Permanently secure the control valve identification label to the top of concrete valve box lids with non-corrosive connectors.

3.07 AUTOMATIC CONTROLS

A. Install the controller and/or associated equipment, enclosure, sensors, decoders and accessories per the manufacturer’s details and installation requirements, and the construction documents.

B. Where the controller is not connected to a building’s electrical grounding system, install a grounding circuit for controller and associated equipment with either a ground rod or ground plate per ASIC Guideline 100-2002.

C. Where the new controllers are a site satellite controller in a central control system, the site satellite controller equipment and installation shall be reviewed for system compliance by an authorized central system distributor/installer.

D. Connect operational control wires or accessory components to the controller, and program valve schedules appropriately for the new planting.

E. The Owner shall review the fully functional operation of the irrigation control system prior to acceptance of the system, and as a requirement for the start of maintenance.

F. Install automatic controller chart in laminated or watertight plastic envelope inside controller cover showing which valves are connected to which stations on controller in the work area.

G. Provide the Owner with one fully charged handheld remote controller unit(s).

3.08 ELECTRICAL SERVICE

A. Electrical service shall be provided to the controller location by the electrical subcontractor. The irrigation subcontractor shall make the electrical power connection to the controller and booster pump per code requirements.

B. Install grounding rods, plates, etc. per manufacturer’s and CEC code requirements

3.09 DRIP IRRIGATION SYSTEM

A. Install control valves, wye strainer, pressure regulator and rigid PVC lateral distribution lines or manifolds prior to planting soil conditioning operations.

B. Install in-line emitter tubing as follows:
    1. After planting soil has been amended, tilled and rough graded, remove and stockpile the planting soil to the required depth of the in-line tubing, and install and stake drip tubing taking into account adjustments needed in the tubing location based on the planting layout. Stake in-line tubing at every-other emitter. Install flush and air relief valves, and operation indicator. Install the operation indicator on the supply manifold with a swing joint in a location easily visible by maintenance personnel.
    2. After system flushing, verification of proper operation and inspection, reinstall the stockpiled planting soil and finish grade to final elevation.

C. Operate the system to moisten the planting soils to a minimum 8 inch depth prior to planting operations.

D. Program the controller to operate the drip system using the controller's "cycle and soak" feature in order to apply the required daily watering amount in three equal cycles with a one hour delay between cycles.

3.10 CONCRETE

A. Concrete shall be installed in accordance with the relevant portions of the Site Concrete specification section.

3.11 COMPLETION AND MAINTENANCE

A. After the system has been completed but prior to the start of maintenance, the Contractor shall operate the automated system with the Owner, shall instruct the Owner in the operations and maintenance of the system and controls, and shall program the controller for each station.

B. If site satellite controller(s) for a central control system is installed, an authorized central control distributor/installer shall program the central base station to communicate with the site satellite controller(s), and shall verify that proper communication protocols are operational.

C. The irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the maintenance period or until Final Acceptance of the project, whichever is greater. Irrigation system maintenance shall commence upon an acceptable review following the completion of irrigation installation, planting operations and general clean-up.

D. The maintenance period shall not terminate until the close-out documents and as-builts record drawings have been submitted and accepted.

3.12 REPAIR AND CLEAN-UP

A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to new planting and improvements. Disturbed and/or damaged areas shall be restored to their original condition to the satisfaction of the Owner.

B. Where trenching or other work disturbs existing and/or newly planted turfgrass and/or planting, the Contractor shall reinstall the existing sod if viable, or install a full width of new turfgrass sod or new planting to match the existing turfgrass/planting species, variety and size, after first conditioning the top 6 inches of soil per the Landscape Planting specification. Adjust finish grades to account for the new turfgrass sod's soil mat so that the new sod is flush to the adjacent turfgrass.

C. After the irrigation operations are completed, the Contractor shall remove all trash, excess materials, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired or material replaced at the Contractor's expense. The site shall be left in a neat and orderly condition to the satisfaction of the Owner.

END OF SECTION

SECTION 32 90 00
LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all material, labor and equipment necessary to install all landscape work as indicated in the plans and specifications.

B. The landscape work includes but is not necessarily limited to the following:
1. Soil preparation including cross ripping of all planting soil.
2. Weed control including an application of a pre-emergent herbicide.
3. Providing import planting topsoil at raised grade planters and/or at planting areas needing fill.
4. Fine grading, conditioning and amending planting topsoil.
5. Planting new trees, plants and ground covers.
6. Tree drainage sump boring and testing.
7. Root Barriers.
8. Installation of mulch.
9. Sixty (60) day maintenance.

C. Related Work Specified Elsewhere
1. Contract Drawings, Addenda, general provisions of the Contract, including General and Supplemental Conditions, and Division 1 Sections apply to work of this section.
2. Section 31 20 00 - Earthwork
3. Section 31 22 22 - Soil Materials
4. Section 32 84 00 - Irrigation System

1.02 1.03 DEFINITIONS

A. Unless noted otherwise, the term "approved" shall mean by the Owner in writing.

B. Agencies and Organizations:
1. ASTM- American Society for Testing and Materials
2. ANSI – American National Standards Institute
3. ISA – International Society of Arborists
4. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.
5. TPI – Turfgrass Producers International

C. Owner: The Owner’s authorized representative or authorized consultant.

1.03 QUALITY ASSURANCE

A. The work of this Section shall be performed by a single firm experienced in landscape planting and holding a current California Contractor’s A or C27 License.

B. Tree and plant quality and sizes shall conform to the current edition of “American Standard for Nursery Stock” for Number One nursery stock as adopted by the American Nursery & Landscape Association (ANSI Z60.1). Plants shall be of uniform, standard size for their listed container size, neither overgrown and root bound or encircling, nor so recently transplanted that the root system is not thoroughly well established throughout the container. Roots should reach the sides of the container and maintain a firm root ball. Pruning shall not be done prior to delivery except by prior approval.

C. Trees shall also comply with quality characteristics described in “Guideline Specifications

for Nursery Tree Quality" current edition, published by the Urban Tree Foundation. Trees not in compliance with any of the following characteristics may be subject to removal and replacement, whether planted or still in their containers.

1. Acceptable caliper and height ranges for the Type, Form and Size of tree.
2. An intact central leader, or after heading of an old leader, the new leader diameter is greater than one-half the diameter of the old leader. Co-dominant leaders are not acceptable.
3. Scaffold branch diameters are less than two-thirds the diameter of the trunk, and without included bark at the attachment.
4. Scaffold branches shall be balanced, well spaced vertically, and with a radially blank section no greater than one-third of the canopy circumference.
5. Temporary branches on the lower trunk shall be less than three-eighths inch diameter, and the clear trunk height shall be no more than forty (40) percent of the overall tree height.
6. The root collar and rootball shall be free of defects, including circling, kinked and girdling roots. Roots at the edge and bottom of the container shall be less than one-quarter inch diameter, and uniformly distributed throughout the container.
7. The tree canopy width shall be a minimum of twenty-five percent of the standard form tree height, except for naturally columnar forms.

D. Botanical names shall take precedence over common names. Provide plants that are true to name. Tag one representative plant of each species and size with the botanical name and size.

E. Inspection:

1. All landscape work and materials shall comply with applicable Federal, State, County and City regulations.
2. All plant material shall be reviewed onsite or by providing photo submittals by the Owner's Representative and/or Landscape Architect prior to positioning and planting. The lack of a review shall not limit the right of rejection during any stage of the work until Final Acceptance for any reason including condition of the foliage or root ball, size, variety, form, appearance, latent defects or injuries or location errors. Rejected or wrongly located plants shall be removed/relocated from/on the site and replaced/replanted immediately by the Contractor as directed at no additional cost to the Owner.

F. Qualifications of Workers

1. Employ skilled workers who are thoroughly trained experienced in landscape planting and who are completely familiar with specified requirements and methods needed for proper performance of the work in this section.
2. Provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.
3. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation. Submit a copy of the Certificate.

G. Any pruning of existing trees specified as part of this Work shall be performed under the direct supervision of an ISA Certified Arborist and in compliance with ANSI A300-Part 1 Standard Practices (Pruning).

1.04 SUBMITTALS

A. In accordance with the Submittal section, submit:

1. A complete materials list of all items proposed to be furnished including estimated quantities.

2. Laboratory analyses of soil conditioning materials, e.g. organic compost, shall have been performed within three months of the submittal date.
3. Quality Certificates and/or Certificates of Inspection required by government agencies (providing duplicate copies for the Owner's Representative).
4. Qualified Applicator Certificate, and DPR Registration Certificates and Material Safety Data Sheets for all pesticides/herbicides proposed for use.
5. Submit photos with a scale marker of all boxed trees, and a representative photo of each species/variety of ground plane plants proposed for use from the nursery source. Photos shall clearly show the individual tree or plant form without background greenery.

B. Soil amendments: Submit one (1) pint sample and an analysis of organic compost and mulch.

C. Other Samples: When requested by the Landscape Architect and/or Owner's Representative.

D. Soil Fertility Analysis and Recommendations:
1. The Contractor shall provide and pay for a fertility analysis of the existing topsoil and any proposed import planting topsoil. After mass grading operations are completed, native soil samples shall be collected for the fertility analysis by collecting a minimum of 5 representative samples of the soil per acre throughout the area of work. Separate samples shall be produced for cut and fill areas, and for any other area composed of soils not similar to the existing soils. Each sample shall be a minimum of one pint each, and shall be thoroughly mixed together to prepare a homogenous sample. A one quart representative sample for cut, fill and any other special conditions shall be submitted to the soil testing laboratory as a representative sample for fertility analysis. The fertility analysis shall at a minimum provide the following data:
   a. soil texture class and percent sands, silts and clays per ASTM D422
   b. estimated soil infiltration and percolation rates
   c. pH
   d. organic matter (%)
   e. total soluble salts (ECe)
   f. Cation Exchange Capacity (CEC) and Percent Cation Saturation for K, Mg, Ca and Na
   g. major and minor nutrients (ppm).
2. Recommendations for improvement of the soil conditions for optimum plant growth shall be made by the testing laboratory, and at a minimum shall include the following:
   a. A fertilizer and amendment application program (including macro and micro nutrients) for both pre-planting and maintenance fertility applications for broad area tillage and for planting pit backfill (pre-plant only).
   b. Treatments to neutralize soil pH and to correct any adverse conditions as warranted.
   c. Recommendations shall address soil conditioning for both planting area tillage and tree/plant planting pit backfill.
3. The soil analysis and recommendations shall be performed by one of the following laboratories capable of providing the above analyses by a licensed soil scientist:
   a. D&D Agricultural Laboratory. Contact Darrin Peters at 559-348-1818.
   b. Wilber-Ellis Company. Contact Michael Cline at 209-442-1220.
4. The Contractor shall submit the results of the soil testing investigations and shall receive written direction from the Landscape Architect before proceeding with any soil conditioning activities such as fertilizing and/or tillage of amendments.

E. Within seven days from the start of the maintenance period, submit a calendar of

maintenance activities, including scheduled dates for mowing, fertilizing, weed control and all other activities. Provide the quantities of maintenance fertilizer and any other materials scheduled to be used in each application during the maintenance period.

F. Submit invoices and/or delivery tags from material suppliers for all amendments, fertilizer, seed, plants, mulch and any other materials provided for the landscape planting installation and applied during the maintenance period. Submit tags from seed packaging indicating seed varieties, percent purity and percent germination minimums. The invoices and/or delivery tags shall be provided directly to the Owner's Representative/Inspector of Record within 24 hours of delivery to the site, as well as to the normal submittal recipients per the Contract Documents.

G. Close-out Documents: Submit prior to the end of the maintenance period. Acceptance of the Close-out documents in a condition for scheduling a Final Acceptance review. Provide two bound copies of the following:
   1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of plant nurseries, materials and equipment vendors with names and addresses of the vendor/manufacturer representatives and warranty periods.
   2. A "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions.
   3. Maintenance Manuals and Instructions: Submit a monthly schedule of procedures to be established by Owner for maintenance of landscapes (trees, mixed planting and turfgrass) for one full year and shall include recommendations for fertilizing, pest and disease control, weeding, mowing, aeration and top dressing.
   4. Soil Amendment and/or Seed/Stolon confirmation form noting the installed quantities of materials, tags or invoices from Subsection F. above, and the person who confirmed the delivery and installation of the materials.
   5. Operations and Maintenance Manuals and Warranty certificates for any maintenance equipment turned over to the Owner.
   6. As-built Record Drawings with all modifications to the Drawings noted in red ink, and the Landscape Planting Observation Log completed.

1.05 AVAILABILITY

A. The Contractor shall confirm availability of plants, supplies, and materials prior to submitting his landscape bid. Plant variety substitutions are not desired.

B. If a plant is found not to be suitable or available, the Contractor is to notify Landscape Architect before bidding. The Landscape Architect is then required to select a reasonable alternate and to inform all those bidding of the availability of the original plant. If a substitute is selected it must be of the same size, value and quality as the original plant. Failure to inform the Landscape Architect of unavailable plants prior to bidding will require that all plants specified shall be provided by the Contractor at time of installation.

C. Plant container size listed on construction documents are minimum acceptable size. If plant material specified is not substituted prior to award of the contract the minimum container size specified shall be provided by the Contractor. If the Contractor can not provide the minimum specified size plant material at the time of installation, the Contractor shall be required to install a larger size container of the plant specified at no additional cost to the Owner.

1.06 EXISTING CONDITIONS

A. The Contractor is to visit the job site to verify existing conditions including soils, vegetative

growth, subsurface conditions, existing grade and drainage, irrigation system etc. making allowances in his bid for any required work to provide the landscape installation as specified in the construction documents.

B. The Contractor shall notify the Owner to locate underground lines prior to hole boring or trenching. Do not permit heavy equipment such as trucks, rollers, or tractors to damage utilities. Hand excavate as required to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned. Prevent damage to temporary risers of underground irrigation system and similar obstructing work located in the landscape areas.

C. If there is a conflict with existing utilities, improvements and/or planting and the proposed planting, Contractor shall promptly notify the Owner's Representative for instructions as to further action. Failure to do so will make Contractor liable for any and all damage or corrective actions arising from his operations.

D. Prior to the start of this work, the Contractor and the Owner's Representative shall verify the operational condition of that portion of the existing irrigation system pertaining to the proposed planting area. The Contractor shall notify the Owner's Representative of any repairs and/or corrections necessary for proper functioning and coverage. The repairs and/or corrections shall be completed before any plant material is planted. Failure to perform system verification and provide notification prior to the start of this work will make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage, as well as any required plant replacement, without any additional cost to the Owner.

E. No plants shall be planted in situations that show poor drainage infiltration or low areas that result in standing water. Such situations shall be corrected by the Contractor as directed by the Landscape Architect or Civil Engineer. Failure by the Contractor to notify the Owner of poor drainage conditions prior to proceeding with the conditioning or planting operations shall place the responsibility for any plant removals, additional soil conditioning and replanting on the Contractor without any additional cost to the Owner. Any corrections of finish grading not in compliance with the Contract Documents including plant removal, soil conditioning and replanting shall be performed by the Contractor at no additional cost to the Owner.

1.07 PROTECTION

A. The Contractor shall guarantee repair of damage to any part of the premises resulting from but not limited to leaks, defects in materials or workmanship, operation of equipment, storage of materials and/or equipment, installation of underground or overhead utilities. The Contractor shall be liable for any and all accidents resulting from his work, including open holes and trenches during construction.

B. Protect new and existing landscape areas in the area of work from theft, loss, damage and deterioration during storage, installation and maintenance. Protect from unauthorized persons (trespassers) as well as from operations by other contractors and tradesmen, and landscape operations. Protect all planted turf and shrub areas from persons as well as operations of other contractors and the Owner. Cost of protection shall be born by the Contractor with means of protection such as temporary fencing as approved by Owner. Cost for protection shall be included in the Contractor's bid for the work.

C. Contractor shall repair or replace damaged work and/or damage to existing improvements/landscape as identified by the Owner's Representative to a condition acceptable to the Owner's Representative. No additional payment will be made to the Contractor for repair or replacement of damaged work and/or damage to existing

improvements/landscape.

1.08 OBSERVATIONS

A. General:
   1. Installation and operations must be approved by the Owner.
   2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.
   3. In all cases, where inspection of the landscape planting work is required and/or where portions of the work are specified to be performed under the direction and/or review of the Owner, the Contractor shall notify the Owner at least 72 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the planting needed because of failure of the Contractor to have the required inspection, shall be performed at the Contractor's own expense.

B. The Owner or the Project Inspector shall perform periodic observations and shall record the observation on the Landscape Planting Observation Log form on the As Built Record Drawings. Field Reports by the Owner's Representative noting the observations may be acceptable if included in the Close-out Documents. Such observations shall include but are not necessarily be limited to:
   1. Weed control operations prior to other portions of work.
   2. Ripping and soil conditioning of the planting area.
   3. Layout of the plant material and trees at the site prior to planting in order to avoid conflicts and to meet the design intent.
   4. Condition and quality of plant material prior to planting.
   5. Auguring, digging and preparation of plant pits and drainage sumps for trees and shrubs.
   6. Planting and staking of trees.
   7. Planting of shrubs, ground cover and turfgrass.

C. Any corrective action called for shall be immediately performed by the Contractor.

D. Failure by the Contractor to obtain the above observations shall place the responsibility on the Contractor for any relocation and/or replacement of planted trees or shrubs.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Plant label shall identify each species and variety. A label shall be attached to each individual plant or block of identical plants grouped together.

B. Adequately protect plants from sun and wind prior to planting. Do not allow stored plant material to dry out at any time.

C. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site. Store materials and equipment in a location as directed by the Owner's Representative.

1.10 PESTICIDE NOTIFICATION

A. A written notification of any and all pesticide/herbicide products scheduled for use by the Contractor or their representative on the Owner's property must be submitted to the Owner's Representative at least seven days prior to the scheduled application. Notification shall include the product name, manufacturer's name, the pesticide active ingredient, the

U.S. EPA and CalDPR registration numbers, the scheduled date and application areas, and the reason (target species) for the application.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil used in planting areas shall be a clean, friable soil without noxious weeds, clods or stones larger than 0.5 inch in diameter, subsoil, hardpan, wood, debris, fine organic material greater than 2% by weight, undesirable insects, plant disease or any other natural or extraneous objects detrimental to normal plant growth.

B. The Contractor shall provide a particle size analysis, fertility testing and amendment recommendations of proposed native and/or import topsoil, and the Landscape Architect reserves the right to reject topsoil not conforming to the minimum specifications. Stockpiled onsite topsoil may be used if analysis and testing determines compliance with these requirements prior to placement. Failure to meet minimum specifications shall result in the removal of any unauthorized placed topsoil at the Contractors expense.

C. Particle size distribution for topsoil shall meet the following per ASTM D422:
1. 100% passing a 12.2 mm (1/2”) screen.
2. Minimum 95% passing a 9.5 mm (3/8”) screen.
3. Minimum 75% passing a 2.36 mm (No. 8) screen.
4. Maximum 45% passing a No. 200 screen.
5. Silt content shall be a maximum 35%.
6. Clay content shall be a maximum 25%.
7. Silt to Clay ratio shall be less than 2 and greater than 0.5.

D. Other characteristics shall conform to the following:
1. Permeability rate shall be not less than one (1.0) inch per hour or not more than 20 inches per hour.
2. The sodium absorption ratio (SAR) shall not exceed 3.0 and the electrical conductivity (ECe) shall not exceed 2.5 milliohms per centimeter at 25 degrees centigrade.
3. Soluble boron shall be no greater than 1.0 part per million (mg/l).
4. Soil pH range shall be 6.5 – 7.9.
5. Maximum concentration of soluble chloride shall be 150 parts per million.
6. Maximum concentration of heavy metals shall not exceed the following when the pH is between 6 and 7:
   a. Arsenic: 0.5 ppm
   b. Cadmium: 0.5 ppm
   c. Chromium: 5 ppm
   d. Cobalt: 1 ppm
   e. Lead: 15 ppm
   f. Mercury: 0.5 ppm
   g. Nickel: 2.5 ppm
   h. Selenium: 1.5 ppm
   i. Silver: 0.25 ppm
   j. Vanadium: 1.5 ppm
7. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
8. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

2.02 SOIL AMENDMENTS

A. Organic Compost: “Harvest Premium” as supplied by Harvest Power (559) 435-1114;

"WonderGrow Compost" by Grover, Inc. (866) 764-5765, or "Allgro Compost" by Synagro (559) 341-5158, or approved equal and conforming to the following minimums per the US Composting Council 'Compost Technical Data Sheet' report dated within three months of the submittal date:

1. Certified as "Mature" or better
2. Pass EPA Class A standards for pathogens and heavy metals.
3. Particle size: 1/8" maximum
4. pH: 6.0-7.5.
5. Macro-nutrients: Minimum of 1.0% Nitrogen, 0.5% Phosphorus, 0.5% Potassium.
6. AgIndex ratio (Nutrients/Salts) 10 or more.
7. Ammonia N/Nitrate N ratio: rated Mature or Very Mature
8. Organic matter content greater than 50% dry weight.
9. Ash: equal or greater than 6%, not greater than 20%
10. Carbon/Nitrogen ratio: less than or equal to 25.
11. Salinity (ECe): less than 10.0 dS/m.
12. Odor shall be soil-like (musty, earthy) without any sour, ammonia-like or putrid smell.

B. Gypsum shall be mined agricultural grade gypsum composed of no less than 95% $CaS0_4$-$2H_20$ hydrated calcium sulfate in a pelletized form. Elemental Sulfur shall be a minimum 95% pure agricultural grade.

C. Dry Humate organic soil conditioner comprised of a minimum 70% humic acid from Leonardite.

D. Endo 120 Mycorrhizae containing a minimum 60,000 living propagules per pound.

E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

2.03 FERTILIZER

A. Trees and Shrubs: Fertilizer for all trees and shrubs to be BEST PAKS (20-10-5) controlled release fertilizer in a biodegradable 10 gram packet. The BEST PAKS shall be applied at the following rates:

1. 1 Gallon Can: 1 Best-Pak
2. 2 Gallon Can: 2 Best-Paks
3. 5 Gallon Can: 5 Best-Paks
4. 15 Gallon Can: 10 Best-Paks
5. 24" Box: 16 Best-Paks
6. 36" Box: 24 Best-Paks

B. The pre-plant fertilizer shall be a commercial homogeneous, granular pellet:

1. Pre-plant fertilizer for turfgrass shall be:
   a. BEST 6-24-24-5S XB+ with Avail
2. Pre-plant fertilizer for mixed plantings shall be:
   a. BEST Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.

C. The maintenance fertilizer shall be a commercial homogeneous, granular pellet:

1. Maintenance fertilizer for mixed plantings shall be the pre-planting fertilizer.

D. Fertilizer material types and analysis may be subject to change based on the findings and recommendations from the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

2.04 MULCH

A. Mulch for on-grade or raised native soil planters shall be a walk-on type of chipped and aged greenwaste woody material without leaves, green wood, sticks, dirt, stones, dust and other non-organic debris as accepted by the Landscape Architect. Particle size 1/2” to 3" in general size.

2.05 STAKING & GUYING MATERIALS

A. Stakes: 2" Diameter Lodgepole Pine or Douglas Fir, pressure treated and pointed one end.

B. Ties: V.I.T. Cinch Tie, 32 inches long, V.I.T. Products, Inc. (619) 673-1760, or equivalent.

2.06 PLANTS

A. Plants shall be typical of their species and variety, shall have normal growth habits, well developed branches and be densely foliated, and shall have fibrous root systems. No substitutions will be allowed unless approved in writing by the Landscape Architect.

B. Plants shall be free from defects and injuries including disease, insects, insect eggs and larvae and girdled or matted roots.

C. Quality and size of plants shall be in accordance with ANSI Z60.1-2004, "American Standard for Nursery Stock", and as described in Quality Assurance.

D. Plants shall not be pruned before planting.

E. Plant material must be selected from nurseries that have been inspected by State or Federal Agencies.

F. Plants shall be nursery grown and shall have been transplanted or root pruned at least once in the past three (3) years. Plants shall have been grown under climatic conditions similar to those in the locality of the project.

G. Each bundle of plants shall be properly identified by weatherproof labels securely attached thereto before delivery to the project site. Label shall identify plant by name.

H. Nomenclature shall be in accordance with Sunset Western Garden Book, current edition.

I. No plants shall be removed from their container until a review has been made in the field or at the nursery, or except when specifically authorized in writing by the Owner.

J. Collected plant material may be used only when approved. Approval shall not limit the right of rejection during work progress for conditions of the root ball, latent defects or injuries.

K. Where shown a "MULTI" provide trees with a minimum of three trunks.

L. Plant sizes listed on the planting plan are minimum acceptable sizes. The quantities listed are the Landscape Architect's estimate only. The Contractor is responsible for the quantities of plant symbols shown on the plan, and/or the quantities in hatched planting areas at the specified triangular spacing.

M.

2.07 ROOT BARRIER

A. A ribbed polyethylene panel of minimum 0.080” thickness equal to Deep Root Partners #UB 24-2 PANEL, (800) 458-7668..

2.08 TREE TRUNK PROTECTOR

A. ArborGard+ polyethylene tree guard by Dimex (800) 334-3776, or equal.

2.09 HERBICIDES

A. Herbicide products for removal of unwanted grass and broad-leafed weeds shall be registered and approved for use by the U.S. EPA and CalDPR, and shall comply with the Owner’s Standards and with the “Healthy Schools Act” with current amendments, and with the current list of prohibited herbicides at Schools and Child Care facilities per California Assembly Bill 405.

B. Provide pre-emergent and post-emergent, selective herbicide formulations for use on turfgrass areas and/or ornamental shrub/ground cover areas that are not injurious to the proposed plantings and turfgrasses.

C. Provide a non-selective contact herbicide formulation only for use to remove existing established weeds prior to new plantings. The herbicide shall be certified for organic use, broad-spectrum with systemic function, ‘Weed Slayer’ by Agro Research International, or equal.

2.10 OTHER MATERIALS

A. Materials not specifically indicated, but necessary for proper execution of the work, shall be of first quality as selected by the Contractor subject to approval of the Landscape Architect.

PART 3 - EXECUTION

3.01 EXAMINATION & PREPARATION

A. General: Verify that existing site conditions are as specified and indicated before beginning this work.

B. Damaged Earth: Verify that earth rendered unfit to receive planting due to concrete water, mortar, limewater, hydrocarbons or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Owner’s Representative.

C. Examine the area and conditions under which the work in this section is to be performed. Verify that any existing irrigation system within the limit of work is in proper working order with full coverage. Correct conditions detrimental to the timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of the work signifies acceptance of the existing conditions.

D. Protection:
   1. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment within the area of work prior to commencing work.
   2. Mark existing irrigation heads, valves, valve boxes and other below grade equipment or components that are scheduled to remain. Protect in place.

E. Runoff and Erosion Control: Furnish equipment, materials and labor necessary to control the flow, drainage, and accumulation of excess water running off the work area and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site per the approved SWPPP.

3.02 ROUGH GRADING, SOIL PREPARATION, PLANTER BACKFILL

A. Rough grading shall be performed by other subcontractors to the extent of establishing rough pads, slopes and drainage patterns. The Contractor is responsible for placement of topsoil and grading required to ensure positive drainage in all turfgrass and planting areas. All planting areas shall have a minimum topsoil depth of 18 inches from on-site native and/or approved import sources. Rough grading shall be completed prior to weed control, cross ripping or rock removal operations.

B. After the completion and acceptance of the weed control operations outlined below, and unless directed otherwise by the Landscape Architect or noted on the Drawings, and except for the area under the canopy of existing trees, the Contractor shall cross rip and till (break up large clumps and clods in excess of 2 inch diameter) the existing soil within all planting areas outside the canopy drip line of existing trees until the soil is loose and friable. Ripping shall be to a minimum depth of twelve inches (12") in turfgrass areas and eighteen inches (18”) in shrub/ground cover areas, with ripping tines a maximum 18” apart performed in a minimum of two passes total in different perpendicular directions. The Contractor shall review the completed ripping operation with the Owner’s Representative and Landscape Architect to determine compliance. The first 6 inches of any new topsoil fill shall be tilled into the existing soil to a minimum depth of 6 inches prior to placing any further topsoil fill. The Contractor shall provide any additional work as directed by the Owner’s Representative after the review to obtain compliance. Do not proceed with the addition of topsoil and/or amendments, or commence rock picking or fine grading until the completed ripping operation is accepted in writing by the Owner’s Representative.

C. Planting area soil under the canopy drip line of existing trees, or in planting beds not accessible by motorized equipment, shall be ripped to a minimum depth of 12 inches using manual spading shovels, forks and/or broadforks and working around major tree roots and/or utilities. In areas receiving new mulch, rip to a minimum depth of 4 inches while protecting any existing plants and their root system. Break up and/or remove rocks and clods as indicated below.

D. Do not work soil when moisture content is so great that excessive compaction will occur, or when it is so dry that dust will form in air or clods will not break up readily, or when a full ripping depth cannot be achieved. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and dust control. Maintain within 2 percent above or below optimum moisture content for the existing soil type at all times during the work.

E. After soil ripping and preliminary finish grading is completed, the topsoil shall be cleared of all concrete, wire, sticks, roots, debris and foreign materials. Remove native stones and clods as follows:
   1. In shrub/ground cover areas, remove stones and clods greater than one (1.0) inches in diameter from the top 3 inches of finish grade.
   2. In general, non-play or sport turfgrass areas, remove stones and clods greater than three-quarter (0.75) inch in diameter from the top 2 inches of finish grade.
   3. In designated play or sports field turfgrass areas, remove stones and clods greater than one-half (0.50) inch in diameter from the top 4 inches of finish grade using a mobile tractor pulled, PTO powered, hydraulic controlled rock picker, Cherrington Model 4500 or similar.

F. Add clean planting topsoil where needed to bring grade to elevation to promote positive drainage. Spread approved planting topsoil over ripped subgrade prior to incorporating amendments.

G. Backfill all raised grade planters with a minimum depth of 18 inches of imported clean sandy loam planting topsoil conforming to Subsection 2.02 and approved prior to import

and/or placement. Failure to obtain import approval prior to backfilling raised grade planters shall result in the removal of any planting and non-approved backfill, and the reinstallation of the work with approved materials.

3.03 WEED CONTROL

A. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation.

B. The Contractor shall treat any weeds in proposed new turfgrass and planting areas with a non-selective contact weed killer at the manufacturer's approved rates and procedures prior to any commencement of work at the site including any irrigation work, ripping of soils or fine grading. Areas planned for turfgrass seed/stolon planting shall in addition receive “grow and kill” weed removal as outlined below.

C. Weed eradication shall be ongoing throughout the course of the landscape installation. The Contractor shall apply a pre-emergent herbicide after shrub/ground cover planting and prior to mulch installation. Manually remove weed seed heads. At no time will weeds be allowed to become established. Contractor shall provide all weed control operations as directed by the Owner’s Representative.

D. All weed control operations using pesticides/herbicides shall comply with the CalDPR and Owner Standards as well as AB2260 “Healthy Schools Act”. The Contractor shall comply with the notification and posting requirements of the “Healthy Schools Act”.
   1. The Contractor shall notify the Owner per Subsection 1.11, A.
   2. The Contractor shall post highly visible signs around the treatment area in conformance with the “Healthy Schools Act” warning of a scheduled pesticide/herbicide application a minimum of 24 hours before to 72 hours after a pesticide application.

E. A non-selective contact herbicide for grassy weeds, ‘20% Vinegar Weed Slayer’ by Good Natured, CA DPR Reg# 85208-1-AA-42177, shall be applied directly to the weed foliage. Only apply to dry surfaces, and a minimum of 8 hours before a rain event. Allow a minimum of 14 days from herbicide application to commence any planting.

F. Perform pre-plant clearing and weed control for native open ground areas planned to receive planting as follows:
   1. Apply irrigation to encourage weed growth prior to ripping, and to maintain moisture in the soil.
   2. Apply a contact herbicide to weed foliage. Remove weeds and expose bare soil.
   3. Lightly disk/till to a depth of three-inches.
   4. Perform a “grow and kill” operation after the first disking/tillage:
      a. Water and lightly fertilize to encourage weed germination.
      b. Follow with a second application of a contact herbicide.
      c. Remove weeds and perform a light harrowing or disking.
   5. Apply irrigation to encourage weed growth. If additional weeds germinate, perform a second “grow and kill” operation.
   6. Once existing weeds are completely removed, obtain authorization from the Owner’s Representative to proceed with deep ripping, rock removal, soil conditioning and finish grading operations. Allow a minimum of 14 days from herbicide application to commence any planting.

G. After the shrub/ground cover planting is complete and prior to mulch installation, apply an approved pre-emergent herbicide per the manufacturer’s recommended rates.

3.04 SOIL CONDITIONING

A. Before commencement of any soil conditioning, weed and rock removal shall be completed as outlined above.

B. Uniformly amend the entire area of topsoil in turfgrass and mixed planting areas per the following bid rates and per the approved modifications as a result of the soils analysis recommendations:
   1. Turf and Non-Sloped (less than 4h:1v) Planting Area Soil Conditioning (per 1,000 square feet).
      a. Compost at a rate of six (6.0) cubic yards (a 2.0 inch thick layer).
      b. Gypsum at a rate of 100 pounds, or Sulfur at 19 pounds, or an equivalent combination.
      c. Humate soil conditioner at a rate of fifteen (15) pounds.
      d. A pre-planting fertilizer to turfgrass areas at a rate of 1.25 pounds of actual P and K.
      e. A pre-planting fertilizer to mixed planting areas at a rate of 1.5 pound of actual N.
      f. Mycorrhizae per Subsection 3.06, Mycorrhizae Application.

C. Till soil amendments into the entire planting area soil to a minimum depth of six (6) inches. Perform the cultivation in at least two passes, one in each perpendicular directions to the first, so that the amendments are homogeneously incorporated into the topsoil. All cultivation inside the dripline of existing trees shall be preformed manually with minimal disturbance to the root system.

D. Planting backfill for trees and shrubs shall be a mix of three parts native soil and one part Compost by volume. Add Humate at 2.0 pounds, and Mycorrhizae at 0.5 pounds per cubic yard of backfill.

E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

3.05 FINE GRADING

A. Upon completion of soil preparation, fine grade all planting and turfgrass areas to a smooth and even slope conforming to and establishing drainage patterns per the approved Grading Plan. Grading shall eliminate all humps and hollows and promote positive drainage in all planting and turfgrass areas.

B. Where hardscape is installed in existing mixed planting areas, a minimum transition grade width of 2 feet adjacent to the edge of hardscape shall be constructed unless noted otherwise. The maximum slope of any transition grade in mixed planting areas shall be 20 percent (1v:5h). The area of transition grading shall be planted or repaired as specified herein.

C. Tolerance of grade differential for planting and general turfgrass areas shall be plus or minus 0.04 foot. If requested, the Contractor shall water test all turf and planting areas after the grading operations are completed in the presence of the Owner's Representative and/or Landscape Architect. The water test shall consist of applying water to the turf and planting areas to the point where water begins to run over the soil to show the drainage pattern. Make all corrections to the finish grading as required by the Owner's Representative to re-established positive drainage patterns. Acceptance of the finish grading shall be obtained in writing from the Owner's Representative and/or Landscape Architect prior to proceeding with soil conditioning and planting operations.

D. Turfgrass sports fields shall be fine graded using a laser controlled machine capable of

producing final grades within 0.02 foot plus or minus from the proposed elevations. The Contractor shall provide an as-graded topographical survey with finish elevations shot on a 25' grid and along transition edges to confirm that the finish grading complies with the design grades with allowances for sod soil mat thicknesses, etc. The Contractor shall allow seven (7) working days in their contract schedule for the as-graded survey to be evaluated and returned to the Contractor and Owner. Acceptance of the finish grading shall be obtained in writing from the Owner's Representative and/or Landscape Architect prior to proceeding with soil conditioning and planting operations.

E. After the finish grading process, relative compaction of the soil in turf and planting areas shall range between 82% and 85% relative density. Compaction/moisture levels are generally acceptable if an Oakfield probe is able to penetrate a minimum of six inches into the cultivated planting topsoil with moderate pressure. The Owner reserves the right to require the Contractor to test for over compaction. If the compaction is within the acceptable range, the test will be paid for by the Owner. All testing due to non-compliance will be paid for by the Contractor.

F. Remove all rocks produced as a result of the soil conditioning and finish grading operations per the requirements of Subsection 3.02.

G. Finish grades shall be one-half inch (1/2") to three-quarter inch (3/4") for turfgrass sod areas, flush (0.0") for turfgrass seed/stolon areas and two inches (2") for shrub/ground cover planting areas below the finish surface of all adjacent walks, curbs, mowstrips and utility/valve boxes or collars. Transition any non-compliant grade in existing turfgrass areas at a maximum 12h:1v slope to meet finish grades above, unless shown otherwise on the grading plan.

3.06 MYCORRHIZAE AND HUMATE APPLICATION

A. In turfgrass planting areas, after fine grading is completed broadcast Mycorrhizae at a rate of one and one half (1.5) pounds per 1,000 square feet (65 lbs. per acre). Lightly rake into the top one inch (1") of topsoil immediately prior to turfgrass installation.

B. In shrub and/or ground cover planting areas, the Mycorrhizae inocculant shall be incorporated into the soil with the other soil amendments at five (5.0) pounds per 1,000 square feet (218 lbs. per acre) per Subsection 3.04, Soil Conditioning. Innocculant shall also be incorporated into the planting backfill per Subsection 3.04, E.

C. In areas receiving turfgrass renovation/aeration, broadcast Humate at a rate of ten (10.0) pounds per 1,000 sf in conjunction with the sand/compost topdress application prior to spreading operation.

D. In existing mixed planting areas where new mulch is to be installed, broadcast and rake Humate into the top 2" of planting soil at a rate of five (5.0 lbs) per 1,000 sf prior to the new mulch installation.

3.07 PLANTING

A. General Requirements
   1. Obtain written approval from the Landscape Architect or Owner's Representative to begin planting operations. The irrigation system shall be fully automated and operational, all weeding, soil conditioning and finish grading completed, and the tree and plant layout approved.
   2. Planting shall be performed by workmen familiar with planting procedures and under the supervision of a qualified foreman. The planting foreman shall be on the job site al all times when planting is in progress.

3. Planting operations shall not occur under unfavorable weather conditions.
4. Boxed trees shall be planted first. Shrub planting shall be completed before groundcover is planted.
5. Proceed and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of planting required.
6. Cooperate with other contractors and trades working in and adjacent to the planting work areas. Examine drawings which show the development of the entire site and become familiar with the scope of other work required.

B. Planting Preparation and Operations

1. Planting material shall be provided with adequate protection of root system and balls from drying winds and sun. Do not bend or bind trees or shrubs in such a manner as to damage bark, break or destroy natural shape. Provide protective covering during delivery.
2. Deliver trees and shrubs after preparations for planting have been completed, and plant immediately. If planting is delayed more than six (6) hours after deliver, set trees and shrubs in shade, protect from weather and mechanical damage and keep roots moist. Do not remove container grown stock from containers until planting time.
3. All planting areas shall be smooth and even. Finish grades shall be done prior to any placement of plants.
4. Place all trees and shrubs in locations shown on the planting plan and obtain written field approval of the Landscape Architect before planting or digging planting pits. Inform the Landscape Architect seven (7) days prior to placing the plants. Maintain a minimum 15 foot clearance from trees to any light pole, unless specifically noted otherwise.
5. Carefully remove all canned stock from containers with tin snips or approved cutter. Cut away and remove any girdled or matted roots.
6. Excavate holes of circular outline with vertical sides for all plants 15 gallon or less. Boxed trees shall have square planting holes. The vertical sides and bottom of the holes shall be thoroughly scarified to promote union of backfill with existing soils. All trees shall have two drainage sump holes drilled with a twelve inch (12") diameter auger penetrating hardpan layers to a minimum one (1) foot into a sand/gravel layer or to a minimum depth of ten (10) feet below the planting pit bottom. Precautions shall be exercised to avoid smooth sides on the holes. Offset augured holes a minimum of eighteen inches (18") from planned tree location to avoid settling of tree after planting.
7. After cleaning out the sump holes, the Contractor shall test the sumps for drainage by flooding with water. If the water does not drain out within twenty-four (24) hours, auger down as required to achieve such drainage by breaking through the hardpan layer, or by extending the drainage sumps to a minimum depth of 15 feet below the bottom of the planting pit. After obtaining approval of the sump holes, fill the augured drainage sump holes with coarse concrete sand.
8. Tree and shrub planting pits shall be at least two and one half (2.5) times the width of the plant container, but a minimum of 36” wide for trees and 18” wide for container shrubs. Planting pits shall be as deep as the soil depth in the container or box, less the additional height of the crown above the finish grade.
9. Set each plant in the center of the pit, plumb and straight. Set the crown of the plant at one inch (1") for shrubs, two inches (2”) for trees above finish grade. When 1/2 of the backfill mix has been placed, tamp-in, insert fertilizer (BEST PAKS as per Section 2.1B1) and allow no air pockets as remainder of backfill is added.
10. Compact soil around the rootball of all plants and thoroughly water in the entire backfill depth.
11. Excess soil from plant holes shall be cultivated and raked to a smooth outline.
12. Shrubs and groundcovers shall be installed in relation to walks and paving to allow for future growth without obstructing traffic with clearance as shown on the drawings.

13. All plants shall be set in watering basin which shall be as wide as the planting pit, but at least four feet (4') in diameter and four inches (4") deep for trees and two feet (2') in diameter and three inches (3") deep for shrubs and vines.
14. Ground cover plants shall be planted at the spacing noted on the drawings. Not more than fifteen minutes shall elapse from the time any groundcover plant is planted until it is watered.

C. Pruning: Prune plants in accordance with established horticultural practice. Shearing of any plants will not be acceptable. Tree pruning shall only be performed with the written approval of the Landscape Architect and under the direction of a certified arborist, and shall comply with ISA Pruning Standards (ANSI 300).

3.08 MULCH

A. Prior to any mulch application, perform weed control operations as specified herein.

B. Where mulch is to be installed in an existing planting area, breakup/till the existing soil in open areas around existing plantings to a minimum 4” depth per section 3.02, and adjust finish grade adjacent to hardscape elements per section 3.05 where not prohibited by existing plantings.

C. Install a minimum 3” layer of mulch in all non-turf planting areas, except for slopes greater than 3h:1v and seeded areas. Install a minimum 2” layer of mulch in all areas receiving flatted plants.

D. Install a minimum 3” layer of wood mulch at a minimum 3’ radius from the tree trunk of all trees located in turfgrass areas. Provide a smooth finish grade transition to a 2 inch depth where the mulch meets the turfgrass, so that the top elevation of the mulch is flush to the turfgrass soil. Keep mulch off the trunk. For new trees in turfgrass areas, remove the watering berm just prior to the turfgrass planting but maintain the mulched area within the planting pit.

3.09 STAKING & GUYING

A. Trees shall be supported by two (2) tree stakes as shown on the drawings. Cut off the top of stakes damaged by installation or where the stake conflicts with canopy branches.

B. Stakes shall be set firmly in the ground outside the rootball and where possible set stakes perpendicular to the prevailing northwest wind.

C. Trees shall be tied to upright stakes loosely with tree ties (see planting detail). Remove the nursery stake.

D. Multi-trunked trees shall be guyed, or individual branches may be staked and loosely tied as shown on the Drawings.

3.10 ROOT BARRIER

A. Install root barrier along hardscape edges whenever the distance from the center of the trunk to the hardscape edge is less than eight (8) feet. Install per the planting details and manufacturers recommendations.

3.11 ARBOR GUARD

A. Install ArborGard+ on all newly planted tree trunks in turfgrass areas per manufacturer's recommendations.

3.12 CLEAN-UP AND REPAIR

A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to existing planting and structures. Disturbed and/or damaged areas, whether a part of this work or from the work of other trades, shall be restored to their original condition.

B. Plants and/or turfgrass shown to remain and damaged or removed by construction operations and/or utility/electrical/drainage lines shall be replaced with plants that match as closely as possible to the existing plant species, variety and size. The replacement turfgrass sod variety shall be the same as shown in the Planting Legend if for new work, or shall match the existing turfgrass variety where the turfgrass is existing. Adjust the finish grade so that the new turfgrass sod abuts flush to the existing turfgrass or to hardscape. The replacement plants and/or turfgrass sod shall be maintained as part of the original scope of work.

C. After the planting operations are completed, the Contractor shall remove all trash, excess soil, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired at the Contractor's expense and the site shall be left in a neat and orderly condition to the satisfaction of the Owner.

3.13 PRE-MAINTENANCE REVIEW

A. A general review will be held prior to the start of the maintenance period upon conclusion of the planting operations, irrigation system installation and after clean-up has occurred. The Owner’s Representative shall be informed in writing a minimum of seven (7) working days prior to the time the work is ready for review in order to arrange a suitable time and date for such review.

B. At the time of review, Contractor shall have all planting areas free of weeds and neatly cultivated and fine graded. All plant basins shall be in good repair. All trees shall be properly staked and tied. All planting areas shall be clear of weeds.

C. The establishment of turfgrass is herein defined as being all work necessary to grow a full, healthy, uniform stand of smooth and even texture and grade with clean straight edges without weeds, distressed areas or bare spots, and has been mowed at least twice per the specifications. The establishment of turfgrass is further defined as being all work necessary to develop a minimum rooting depth of 2 inches into site soil.

D. Work requiring corrective action or replacement in the judgment of the Owner’s Representative shall be performed within five (5) days after the inspection. Corrective work and materials replacement shall be in accordance with the drawings and specifications and shall be made by the Contractor at no cost to the Owner. A subsequent review shall then be arranged.

E. If after the review, the Landscape Architect is of the opinion that all the work has been performed as per the Contract Documents, and a uniform stand of healthy dense turfgrass has been established without weeds or bare spots, the Contractor will be given written notice that the maintenance period may begin.

3.14 MAINTENANCE - GENERAL

A. After all work indicated on the drawings or herein specified has been completed, reviewed, and approved, and the turfgrass has been successfully established per the requirements below, the Contractor shall commence a sixty (60) calendar day maintenance period in which the Contractor shall continuously maintain all areas included in the contract during

the progress of the work and throughout the maintenance period, or until Final Acceptance of the project, whichever is greater.

B. Establishment and maintenance work includes monitoring the site to control all watering, replanting, fertilizing, mulching, weeding, cultivating and mowing necessary to bring the planted areas to a healthy and vigorous growing condition, and any additional work needed to keep the areas neat, edged, weed and trash free, and attractive.

C. All trees, shrubs, ground cover shall be kept at optimum growing condition by watering weeding, replanting, fertilizing, cultivating, tree stake repair, spraying for diseases and insects, replace dead or dying materials, pruning as directed, maintaining proper grades of plants, and providing any other reasonable operations of maintenance and protection required for successful completion of the project.

D. Any date when the Contractor fails to adequately water, replace unsuitable planted areas and other work determined to be necessary by the Owner, will **NOT** be credited as part of the establishment/maintenance period.

E. No additional payment will be made for additional time necessary for turfgrass establishment. The maintenance period shall not start until all contract work has been completed and all close-out documents and materials have been submitted. Turfgrass will be considered weed-free if there is a maximum of one percent undesirable turfgrass species, and nine weeds or less per 50 square yards (one per 50 square feet).

F. During the progress of the maintenance period, the Contractor and the Owner's Representative shall conduct reviews at no less than 21 day intervals to determine that ongoing maintenance activities have been conducted by the Contractor. If in the opinion of the Owner, ongoing maintenance has not been conducted by the Contractor in a satisfactory manner the maintenance period shall be suspended. The Contractor shall provide remedial work as directed by the Owner's Representative to correct the found deficiencies and schedule another review. If after the subsequent review the work is deemed acceptable, the maintenance period shall resume.

3.15 MAINTENANCE - FERTILIZATION

A. The Contractor shall fertilize the non-turf planted areas during the last week of the maintenance period with the mixed pre-planting fertilizer (14-6-11.6) at a rate of six (6.0) lbs./1,000 s.f. and as modified by the soil fertility recommendations and approved by the Landscape Architect. The Contractor shall allow for at least two separate fertilizer formulation applications in each fertilization operation.

3.16 MAINTENANCE – REPAIR AND WEEDING

A. Visible weeds shall be removed at least weekly during the maintenance period. At the end of the maintenance period, all planting areas shall be without weeds. If weeds are present, the Contractor shall manually remove the weeds and shall then apply a granular, selective pre-emergent herbicide at manufacturer's approved rates. Coordinate application with the Owner's Representative and provide certificates of application to Owner's Representative. The turfgrass will be considered weed-free if there are 9 weeds or less per 50 square yards (one per 50 square feet).

3.17 FINAL REVIEW

A. A Final Review will not be scheduled until all Close-out Documents and materials have been submitted and accepted.

B. A Final Review will be performed before the end of the Maintenance Period or upon the pending Final Acceptance of the work, whichever is earlier, provided all deficiencies revealed during the maintenance period have been corrected. If deficiencies have not been corrected by the end of the stated maintenance period, the Contractor shall continue to fully maintain the project at his own expense. After all deficiencies have been corrected, a Final Review will be held with the Landscape Architect, Owner's Representative, and Contractor.

C. Final Acceptance of turfgrass is contingent on a weed free, healthy uniform stand without dead, bare or distressed areas with a minimum rooting depth of five (5) inches into site soil.

D. If after the Final Review, the Landscape Architect and Owner's Representative are of the opinion that the work is acceptable and complete, the Contractor's maintenance responsibility shall terminate on an agreed upon date.

3.18 WARRANTY AND REPLACEMENT

A. All trees and plants provided under this Contract shall be guaranteed to be in good, healthy, disease/pest free and in a flourishing condition one growing year from the date of Final Acceptance of the work, provided the Owner maintains the plants properly and in accordance with accepted horticultural practices. Species and size of any tree and/or plant replacements, either prior to or after Final Acceptance, shall be equal to that of the same adjacent trees and/or plants at the time of replacement as determined by the Landscape Architect.

B. The Contractor shall be responsible to replace all lost plants due to theft, vandalism or any other preventable causes till Final Acceptance of the work by the Owner. Replacement trees and plants shall be planted as originally specified and detailed. Replacement trees and plants shall be guaranteed as specified above from the date of replacement. The maintenance period may be extended for a duration of not more than the original maintenance period duration for the establishment of replacement plants.

C. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects or actions of trees, plants, materials, equipment or workmanship one year from the date of Final Acceptance or the Notice of Completion, whichever is later.

END OF SECTION

SECTION 33 12 00
WATER UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Pipe and fittings for on-site domestic piping.

B. Valves and valve boxes.

C. Accessories.

1.2 RELATED SECTIONS

A. Contract General Conditions and Division 01 Specifications.

B. Section 31 11 00 - Site Clearing.

C. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading

D. Section 31 22 22 - Soil Materials.

E. Section 31 23 33 - Trench Excavation and Backfill.

F. Section 32 13 13 - Site Concrete Improvements.

1.3 REFERENCES

A. ASTM Test Method D1557.

B. ANSI/ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

C. ANSI/AWWA C110 - Ductile Iron and Grey-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.

D. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

E. ANSI/AWWA C500 - Gate Valves, 3-inch through 48-inch NPS, for Water and Sewage Systems.

F. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water.

G. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and Class 200.

H. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

I. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Contract General Conditions and Division 01 Specifications.

B. Accurately record actual locations of piping mains, valves, connections and appurtenances, referenced to permanent surface features.

C. Identify and describe discovery of uncharted utilities or utilities found at locations different than indicated on plans.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with product manufacturer's recommendations and these Contract Documents.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle all products required.

PART 2 PRODUCTS

2.1 WATER PIPE

A. Ductile Iron Pipe (for iron pipe larger than 3 inches in diameter, above ground): ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.

1. Fittings: ANSI/AWWA C110/A21.10, ductile iron.

2. Joints: Flanged.

B. Ductile Iron Pipe (for iron pipe larger than 2 inches in diameter, above ground): ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with

1. Fittings: ANSI/AWWA C110/A21.10, ductile iron.

2. Joints: Threaded

C. PVC Pipe (for pipe 3 inches and smaller, underground): ASTM D1785, Schedule 40.

1. Fittings: ASTM D 2464, Schedule 80 PVC (ASTM D 2466, Schedule 40 PVC for pipes 1-1/2 inches and smaller).

2. Joints: ASTM D 2855, solvent weld.

D. PVC Pipe (for pipe 4 inches and larger, underground): ANSI/AWWA C900 Class 305.

1. Fittings: ANSI/AWWA C111, ductile iron.

2. Joints: ASTM D 3139 compression gasket ring.

E. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed “CAUTION - WATER LINE BELOW”.

2.2 VALVES - UP TO 2 INCHES (50 MM)

A. Use full port ball valves for 2 inches and smaller and resilient wedge gate valves for 2-1/2 inches and larger size.

B. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends.

2.3 GATE VALVES - 2-1/2 INCHES (63 MM) AND OVER

A. ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut or control handle wheel, resilient single wedge, threaded or flanged.

2.4 VALVE BOXES

A. Precast concrete with cast iron lid marked for service Christy No. G5 or approved equal.

B. Valve boxes shall have a minimum 6 inch wide by 4 inch (6” inches in vehicular areas) thick concrete collar.

2.5 ACCESSORIES

A. Concrete for Thrust Blocks and Valve Box Surface Collars: Concrete type specified in Specification Section SITE CONCRETE IMPROVEMENTS.

B. Valve Boxes and Covers: Christy No. G5 traffic box, or approved equal. Cover marking shall read "Water". A one-piece PVC riser extension shall be provided as necessary to allow unobstructed access to valve operating nut.

C. Solvent Cement and Primer for PVC Pipe and Fittings: Per ASTM F656 and ASTM D2564.

D. Non-Firming Anticorrosion Wrap: Trenton Wax-Tape #1 or approved equal for application on belowground metal surfaces, pipe, or fittings in corrosive soils.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions. All plot dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and report any variations to the Engineer.

B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. Carefully investigate the structural and finished conditions affecting all work, and plan work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Unless dimensions are shown, drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between water systems, planting, and architectural features will be minimized.

C. Do not install the facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Engineer before proceeding.

3.2 PREPARATION

A. Prepare for pipe installation by assembling all needed materials.

B. Cover all PVC pipe during storage.

3.3 BEDDING

A. Excavate trench, pit or hole in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.

B. Where trench or pit has been overexcavated, place bedding material at bottom of excavations, level soil materials in continuous layers not exceeding 8-inches loose uncompacted depth.

C. Backfill around sides and to a level 12-inches above the top of pipe with bedding sand, tamped in place.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Install pipe at locations and depths indicated on plans.

B. Install pipe, fittings, and associated materials in accordance with manufacturer's recommendations.

C. Route pipe in straight line, whenever possible. All changes in direction of pipes shall be made with fittings, not by bending.

D. Install pipe to allow for expansion and contraction without stressing pipe or joints.

E. Form and place concrete for thrust blocks at each elbow, tee, angle or other significant change of direction in loose-joint pipe, per detail on plans.

F. Establish elevations of buried piping to ensure not less than 30-inches of cover, except at connections to existing lines, which may be shallower or deeper, or where shown otherwise on plans.

G. When two water pipes are to be installed in same trench, maintain a minimum 4-inch horizontal clearance between pipes.

H. Backfill trench or other excavation in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.

3.5 INSTALLATION - VALVES

A. Set valves on solid bearing.

B. Where valves are installed below finish surface grade, center and plumb valve box and any necessary extensions over valve. Set box cover flush with finished grade.

C. Pour concrete collar around top of valve box per detail on plans.

D. Furnish and install valves and valve boxes in addition to those shown on plans as required for isolation of lines for construction and disinfection, while minimizing disruption of service to buildings, at no additional cost to the Owner.

3.6 INSTALLATION - THREADED CONNECTIONS

A. Assemble all plastic and galvanized steel threaded pipe and fittings using an approved Teflon tape applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved Teflon tape will be required.

B. At all plastic (PVC) pipe connections, work the ductile iron connections first. Connections shall always be plastic into steel, never steel into plastic.

C. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of Teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

3.7 PRESSURE TESTING OF SITE WATER PIPING SYSTEM

A. General: Unless otherwise directed, tests shall be witnessed by Inspector. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered 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 re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

B. Water Piping: Pressure test all onsite water piping systems in accordance with AWWA Standard C605, “Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings”. The pressure testing process shall be performed in cooperation with the authority having jurisdiction and witnessed by the Owner’s Inspector. The constructor shall supply an affidavit of compliance to the Owner as required by AWWA Standard 605. Maintain 150 PSIG water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes. Flush all lines prior to pressure test.

C. Backflow Preventer: All backflow preventers shall be tested according to manufacturer’s recommendations and the USC Cross Connection Control and Hydraulic Research Manual latest edition and per local AHJ requirements. Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall provide written certification to the Architect showing the date in which the backflow preventers were tested and confirmation that unit passed all test requirements.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651, "Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by the Owner’s Inspector. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner by the Owner’s Inspector.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of the Contract General Conditions and Division 01 Specifications.

B. Compaction testing of bedding and backfill will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest. Any retests required due to failure of initial tests shall be paid for by the Contractor.

END OF SECTION

SECTION 33 30 00
SITE SEWER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Sanitary Sewer Pipelines and Fittings

B. Site Accessories

1.2 RELATED SECTIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications sections, apply to the work of this section.

B. Section 31 11 00 - Site Clearing

C. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading

D. Section 31 22 22 - Soil Materials

E. Section 31 23 33 - Trench Excavation and Backfill

F. Section 32 13 13 - Site Concrete Improvements

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Safety Regulations: Work shall comply with all Federal, State and Municipal regulations regarding safety, including the requirements of the following:

a. William-Steiger Occupational Safety & Health Act of 1970.

b. State of California, California Administrative Code, Title 8 Industrial Relations, Chapter 4, Subchapter 4, "Construction of Safety Orders" and other State and local agencies having jurisdiction.

c. All trenching work shall conform to Trench Construction Safety Orders of California State Industrial Accident Commission.

1.4 REFERENCES

A. American Water Works Association (AWWA).

B. American Society for Testing and Materials (ASTM):

1. Designation D3034 - Polyvinyl Chloride (PVC) pipe.

C. California Plumbing Code, Latest Edition (CPC).

D. Local County Health Department Standards.

1.5 SUBMITTALS

A. Submit under provisions of Specification Section - SUBMITTAL PROCEDURES.

B. Certificates of compliance for material

C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.

D. Submit manufacturer's data and/or fabrication drawings for Sanitary Sewer Pipelines, Sanitary Sewer Manholes and Sanitary Sewer Fittings, installed under this Section. No items shall be incorporated into the work until submittals are approved by the Engineer.

1.6 COORDINATION

A. Verify location of existing utilities have been indicated at by local utility authorities.

1.7 EXISTING UTILITIES

A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by local utility authorities.

D. Maintain all existing utility mains and service lines in constant service during construction of the Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sanitary sewer pipelines for pipes 4 inches and larger shall be polyvinyl chloride (PVC) pipe conforming to ASTM Designation 3034, SDR-35, with elastomeric gasket joints per ASTM D 3212 and F477.

B. Sanitary sewer pipelines for pipe less than 4 inches shall be Schedule 40 PVC pipe, ASTM D1785.

C. All sanitary sewer fittings shall be watertight connections using PVC sewer fittings as approved by the California Plumbing Code, or approved equal to be determined by the Civil Engineer.

D. Surface cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing and current plumbing code.

E. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed “CAUTION - SEWER LINE BELOW”.

PART 3 EXECUTION

3.1 CLEARING OF WORK SITE FOR SITE IMPROVEMENTS

A. Clear site for improvements per construction drawing demolition plan and in accordance with Specification Section SITE CLEARING.

3.2 TRENCH EXCAVATION

A. Trench excavation and backfilling shall be in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL and construction drawing detail.

3.3 SOIL MATERIALS

A. Excavated materials and imported materials shall meet engineering recommendations in accordance with Specification Section SOIL MATERIALS.

3.4 PIPE INSTALLATION

A. Pipe Laying: Alignment and elevation stakes shall be set at intervals with offsets and cut to the invert of the pipe.

1. Proper facilities shall be provided for stringing and lowering sections of pipe into the trench. The pipe shall be laid carefully to lines and grades given.

2. The grade line shown on the plans indicates the flow line or invert of the pipe and all cuts, unless otherwise indicated, refer to this line.

3. After the trench for pipe has been brought to the proper line and grade, the pipe shall be laid in the following manner.

    a. Pipe laying shall proceed upgrade with the bell ends of bell and spigot pipe placed upstream. Each section of pipe shall be laid to line and grade as herein specified and in such a manner as to form a watertight, concentric joint with the adjoining pipe. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses. Pipe shall not be laid when the condition of the trench or weather is unsuitable. All open ends of pipe and fittings shall be adequately and securely closed whenever the work is discontinued for more than one-half hour. If pipe with elliptical or quadrant reinforcement is used, care shall be taken to properly orient the axis.

4. All joint surfaces shall be cleaned before joints are made.

5. The Contractor shall furnish and use, for grade and alignment control, a laser beam system which complies with OSHA requirements. The laser system shall have good visibility when used with suitable target material. The laser system must be of the self-leveling type so that the laser beam is automatically compensated for minute grade disturbances.

6. The laser system must also have an early warning system that instantly warns the pipe layer when the laser is off grade. The laser system is to be provided by the Contractor and shall have a minimum accuracy of ±0.01 foot per one hundred feet (100') on line; and a minimum visible range of one thousand feet (1000'). When conditions are such that this method is impractical, such as on short pipe runs, the Contractor shall have an Engineer on the ground to set grade of each joint of pipe by means of an Engineer's level.

B. Sewer Systems Plugs: Temporary plugs of brick or mortar shall be installed on all sewer projects at points of connection to existing facilities. These plugs shall remain in place until completion of the balling and flushing operation. The plugs, intended to prevent water from the balling and flushing operation, drainage, or any other condition from entering the existing system, shall be installed or removed in the presence of and under the direct supervision of the Engineer. Until the system has been pumped clear of accumulated water, the plugs shall not be removed. This water must not be allowed to enter adjacent sewer or drainage systems.

C. Internal Inspection: Upon completion of construction and prior to final inspection, the Contractor shall clean the entire new pipeline of all dirt and debris. Any dirt or debris in previously existing pipes or ditches in the area, which in the opinion of the Engineer resulted from the new installation, shall also be removed by the Contractor. Sewer pipes shall be cleaned by the controlled balling method. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt, and debris from entering the existing facility. Temporary

plugs for sewer systems shall also conform to Subsection B, above. Water from the drainage system operations shall be routed through a suitable trap to collect any dirt and debris prior to discharging into any downstream facility. The Contractor shall notify the Architect immediately after completion of the pipe cleaning operations. Cleaning of drainage pipes by the controlled balling method will not be required.

D. As soon as possible after the completion of the pipe cleaning, and prior to final acceptance, the Architect or Engineer may make a visual internal inspection of the new pipeline either manually or with television equipment.

3.5 COORDINATION

A. Coordinate with the campus for the shutdown of the existing sewer system to make new sewer connection. Install sewer pipelines before making tie-in to the existing sewer pipeline. Tie-in work may proceed during the campus non-use of the existing sewer system such as on weekends.

3.6 TESTING OF SANITARY SEWERS

A. After cleaning per Section 3.4-C, each section of sewer constructed shall be tested in accordance with acceptable "Low Pressure Air Test for Sanitary Sewers" methods such as presented in the Journal of Sanitary Engineering, Division ASCE, April 1964, to test the point of effluent disposal. All lines and components shall be leak proof.

3.7 INSPECTION OF SANITARY SEWERS

A. System components shall be properly identified as to the manufacturer.

3.8 CLEAN-UP

A. Remove from the site all rubbish, debris, etc. in a lawful manner, resulting from work in this Section. The clean-up shall include the replacement and repair of any damaged or disturbed property.

END OF SECTION

SECTION 33 40 00
STORM DRAINAGE

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. Provide all materials, labor, equipment and services necessary to furnish and install Storm Drainage System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

B. RELATED SECTIONS:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 00 and 01 sections, apply to this work.

2. Section 31 22 22 – Soil Materials

3. Section 31 23 33 – Trench Excavation and Backfilling.

4. Section 32 13 13 – Site Concrete Improvements.

1.3 REFERENCES

A. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. ANSI/ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

C. ANSI/ASTM C478 Precast Reinforced Concrete Manhole Sections.

D. ASTM D1557

1.4 DEFINITIONS

A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.

B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Submit under provisions of Division 01.

B. Certificates of compliance for material.

C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.

D. Submit manufacturer's data and/or fabrication drawings for all pipes, and appurtenances installed under this Section. No items shall be incorporated into the work until submittals are approved by the Architect/Engineer

1.6 COORDINATION

A. Coordinate work with Owner’s personnel.

B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner’s personnel.

C. Coordinate work with other project work.

1.7 EXISTING UTILITIES

A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by Owner’s personnel.

D. Maintain all existing utility mains and service lines in constant service during construction of the Work

1.8 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of utilities encountered.

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforced Concrete Pipe for pipe larger than fifteen (15) inches: ANSI/ASTM C76, Class 3, with rubber gasket joints per ANSI/ASTM C443.

B. Storm drainage sewer pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM designation 3034, SDR 35, with elastomeric gasket joints per ASTM D 3212 for pipe fifteen (15) inches or less.

C. Storm drainage pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM D1785, Schedule 40, for pipe three (3) inches or less.

D. Poured in Place Concrete: Specification Section SITE CONCRETE IMPROVEMENTS.

E. Mortar: Composed of one part, by weight, portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.

F. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.

G. Soil Fill for Concrete Pipe Bedding Envelope: Specification Section TRENCH EXCAVATION AND BACKFILL.

H. Catch basins and drain inlets shall be constructed as per detail drawing.

I. Concrete collar shall be constructed as per detail drawing.

J. Cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing.

K. All metallic pipe, fittings and appurtenances in contact with soil shall be coated or wrapped with an approved material, as required to protect it from corrosive soil.

L. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed “CAUTION – STORM SEWER LINE BELOW”.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

3.2 PREPARATION

A. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

D. Protect existing structures and other improvements to remain from damage from excavation equipment and vehicular traffic.

E. Employ equipment and methods appropriate to the work site.

F. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater existing drainage basins and existing drainage pipeline systems as necessary to accomplish the work.

G. Comply with safety requirements as they pertain to excavations, per Specification Section EARTHWORK.

H. Remove all interfering surface and subsurface improvements authorized for removal.

3.3 EXCAVATION

A. Excavate soil required to locate existing utilities and install the work.

B. Excavate trenches and pits per Specification Section EARTHWORK.

C. Excavate trenches and pits to allow installation and construction of the storm drainage facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans.

D. Excavate trench to depth which is 6 inches below the outside bottom of the pipe barrel to be placed therein.

E. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding as indicated on the plans. Minimize trench width above the pipe.

F. Provide protection to public per Division 01.

3.4 INSTALLATION AND BEDDING OF STORM DRAIN PIPE

A. Install the pipe and fittings to the lines and grades shown on the construction plans.

B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.

C. Unless otherwise approved by the Engineer, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.

D. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.

E. Ensure that all joints are properly "homed" and are watertight.

F. Bed concrete pipe in backfill or sandfill soil envelope, and compact to a minimum of 90% relative compaction. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (6 inches below the outside bottom of the pipe barrel) to a level 12 inches above the outside top of the pipe barrel.

3.5 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTANCANCES

A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer's recommendations, and as specified herein.

B. Construct poured-in-place concrete per Specification Section SITE CONCRETE IMPROVEMENTS.

C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.

D. Construct cleanout, outfall structure per detail drawing.

3.6 BACKFILLING TO FINISHED GRADE AND FINISHED GRADING

A. Place and compact backfill per Specification Section TRENCH EXCAVATION AND BACKFILL.

B. Conform finished surface to the lines, grades and cross-sections shown on the plans, or as otherwise directed by the Inspector.

C. In areas to receive paving or a significant thickness of sealing material, temporarily set manhole frame and cover below finish grade, then return after final surfacing and/or pavement sealing and bring manhole frame and cover to final grade, as shown on the plans.

D. Fine grade all finished soil surfaces disturbed to the lines, grades and cross-sections shown on the plans.

E. Rake and smooth all finished dirt surfaces.

3.7 TOLERANCES

A. Pipe laying tolerances:

1. Above grade: Not to exceed 1/4-inch above planned grade.

2. Below grade: Not to exceed 1/2-inch below planned grade.

3. Alignment: Not to exceed 2 inches from planned alignment, if gradual and regular over a distance of 20 feet.

B. Structure finish grade tolerance: Within 1/4 inch of planned grade, but must match adjacent improvements.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest at no additional cost to Owner.

END OF SECTION

REQUIREMENTS CHECKLIST

CALIFORNIA GREEN BUILDING STANDARD 2022
NON-RESIDENTIAL MANDATORY MEASURES

Project Name: 26TH STREET MARS/ELOP
Project Number: 23-123377
Date: 07/02/25

DIVISION 5 MANDATORY STANDARDS FOR NONRESIDENTIAL BUILDINGS

SECTION 5.1- PLANNING AND DESIGN

Code Section	Requirement	Included in Scope	Discipline	Reference	Comments
5.106.4.2.1	Bicycle parking: Student bicycle parking.	-	-	N/A	No new parking added.
5.106.4.2.2	Bicycle parking: Staff bicycle parking.	-	-	N/A	No new parking added.
5.106.5.3	Electric vehicle (EV) charging. EVCS = 4 Future Required for 17 Parking Stalls . No EVCS/EVSE Required per 5.106.5.3.1	X	A	A100 Overall Site Plan	Limited Parking Improvements
5.106.5.3.1	Electric vehicle (EV) charging: Single charging space requirements.	-	-	N/A	Limited Parking Improvements
5.106.5.3.2	Electric vehicle (EV) charging: Multiple charging space requirements.	-	-	N/A	Limited Parking Improvements
5.106.5.3.4	Electric vehicle (EV) charging: Identification.	-	-	N/A	Limited Parking Improvements
5.106.5.3.5	Electric vehicle (EV) charging: Future charging stations.	X	E	E100 Elec Site Plan	Limited Parking Improvements
5.106.8	Light pollution reduction.	X	MB	Modular Drawings	-
5.106.10	Grading and paving.	X	C	Civil Drawings	-
5.106.12	Shade trees.	X	L	Landscape Drawings	-
5.106.12.1	Shade trees: Surface parking areas.	X	-	Landscape Drawings	-.
5.106.12.2	Shade trees: Landscape areas.	X	L	Landscape Drawings	-
5.106.12.3	Shade trees: Hardscape areas.	X	L	Landscape Drawings	-

SECTION 5.2 - ENERGY EFFICIENCY

Code Section	Requirement	Included in Scope	Discipline	Reference	Comments
5.201.1	California Energy Code.	X	MB	Modular Drawings	-

SECTION 5.3- WATER EFFICIENCY AND CONSERVATION

Code Section	Requirement	Included in Scope	Discipline	Reference	Comments
5.303.3.1	Water conserving plumbing fixtures and fittings: Water closets.	X	MB	Modular Drawings	-
5.303.3.2.1	Water conserving plumbing fixtures and fittings: Urinals – Wall mounted Urinals.	-		N/A	Not in scope.
5.303.3.2.2	Water conserving plumbing fixtures and fittings: Urinals – Floor mounted Urinals.	-		N/A	Not in scope.
5.303.3.3.1	Water conserving plumbing fixtures and fittings: Showerheads – Single showerhead.	-		N/A	Not in scope.
5.303.3.3.2	Water conserving plumbing fixtures and fittings: Showerheads – Multiple showerheads serving one shower.	-		N/A	Not in scope.
5.303.3.4.1	Water conserving plumbing fixtures and fittings: Faucets and fountains – Non-residential lavatory faucets.	X	MB	Modular Drawings	-
5.303.3.4.2	Water conserving plumbing fixtures and fittings: Faucets and fountains – Kitchen faucets.	-		N/A	Not in scope.
5.303.3.4.3	Water conserving plumbing fixtures and fittings: Faucets and fountains – Wash fountains.	-		N/A	Not in scope.
5.303.3.4.4	Water conserving plumbing fixtures and fittings: Faucets and fountains – Metering faucets.	X	MB	Modular Drawings	-
5.303.3.4.5	Water conserving plumbing fixtures and fittings: Faucets and fountains – Metering faucets for wash fountains.	-		N/A	Not in scope.
5.303.6	Standards for plumbing fixtures and fittings.	X	MB	Modular Drawings	-
5.304.6.1	Outdoor potable water use in landscape areas: Newly constructed landscapes.	-		N/A	Not in scope.
5.304.6.2	Outdoor potable water use in landscape areas: Rehabilitated landscapes.	X	L	Landscape Drawings	-

SECTION 5.4 - MATERIAL CONSERVATION AND RESOURCE EFFICIENCY

Code Section	Requirement	Included in Scope	Discipline	Reference	Comments
5.407.1	Weather protection.	X	MB	Modular Drawings	-
5.407.2.1	Moisture control: Sprinklers.	X	L	Landscape Drawings	-
5.407.2.2	Moisture control: Entries and openings.	X	MB	Modular Drawings	-
5.407.2.2.1	Moisture control: Entries and openings – Exterior door protection.	X	MB	Modular Drawings	-
5.407.2.2.2	Moisture control: Entries and openings – Flashing.	X	MB	Modular Drawings	-
5.408.1.1	Construction waste management: Construction waste management plan.	X	SC/MB	Specification Sec. 017419	Requirements defined.
5.408.1.2	Construction waste management: Construction waste management company.	X	SC/MB	Specification Sec. 017419	Requirements defined.
5.408.1.3	Construction waste management: Waste stream reduction.	X	SC/MB	Specifications Sec. 017419	Requirements defined.
5.408.1.4	Construction waste management: Documentation.	X	SC/MB	Specifications Sec. 017419	Requirements defined.
5.410.1	Recycling by occupants.	-		N/A	Existing recycling program.
5.410.1.2	Sample ordinance.	-		N/A	Existing recycling program.

SECTION 5.5- ENVIRONMENTAL QUALITY

Code Section	Requirement	Included in Scope	Discipline	Reference	Comments
5.504.3	Covering of duct openings and protection of mechanical equipment during construction.	X	MB	Modular Drawings	-
5.504.4.1	Finish material pollutant control: Adhesives, sealants, caulks.	X	MB	Specification Sec. 018113	Requirements defined.
5.504.4.3	Finish material pollutant control: Paints and coatings.	X	MB	Specification Sec. 018113	Requirements defined.
5.504.4.3.1	Finish material pollutant control: Paints and coatings – Aerosols paints and coatings.	X	MB	Specification Sec. 018113	Requirements defined.
5.504.4.4	Finish material pollutant control: Carpet systems.	X	MB	Specification Sec. 018113	Requirements defined.
5.504.4.4.1	Finish material pollutant control: Carpet systems – Carpet cushions.	-	-	N/A	Not in scope.
5.504.4.4.2	Finish material pollutant control: Carpet systems – Carpet adhesive.	X	MB	Specification Sec. 018113	Requirements defined.
5.504.4.5	Finish material pollutant control: Composite wood products.	X	MB	Specification Sec. 018113	Requirements defined.
5.504.4.6	Finish material pollutant control: Resilient flooring systems.	-	-	N/A	Not in scope.
5.504.5.3	Filters.	X	MB	Specification Sec. 018113	Requirements defined.
5.505.1	Indoor moisture control.	X	MB	Modular Drawings	CFM indicated.
5.506.1	Outside air delivery.	X	MB	Modular Drawings	-
5.504.4	Acoustical control.	-		N/A	No qualifying sources.
5.507.4.1	Acoustical control: Exterior noise transmission, prescriptive method.	-		N/A	No qualifying sources.
5.507.4.1.1	Acoustical control: Exterior noise transmission, prescriptive method – Noise exposure where noise contours are not readily available.	-		N/A	No qualifying sources.
5.507.4.2	Acoustical control: Performance method.	-		N/A	No qualifying sources.
5.507.4.2.1	Acoustical control: Performance method – Site features.	-		N/A	No qualifying sources.
5.507.4.2.2	Acoustical control: Documentation of compliance.	-		N/A	No qualifying sources.
5.507.4.3	Acoustical control: Interior sound transmission.	-		N/A	No qualifying spaces.
5.508.1.1	Ozone depletion and greenhouse gas reductions: Chlorofluorocarbons (CFCs).	-		N/A	No CFCs present in equipment.

Disciplines
C Civil Engineer
L Landscape Designer
MB Modular Building Manufacturer
SC Site Work Contractor

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED MERCED CITY SCHOOL DISTRICT
NEW PROGRAMMING BUILDING
2600 'K' STREET
MERCED, CALIFORNIA

PROJECT NO. 012-24185
NOVEMBER 20, 2024

PREPARED FOR:

MR. BRYAN BEHN
MERCED CITY SCHOOL DISTRICT
444 W. 23RD STREET
MERCED, CALIFORNIA 95340

Prepared by:

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Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

November 20, 2024 KA Project No. 012-24185

Mr. Bryan Behn
Merced City School District
444 W. 23rd Street
Merced, California 95340

RE: Geotechnical Engineering Investigation
Proposed Merced City School District New Programming Building
2600 'K' Street
Merced, California

Dear Mr. Behn:

In accordance with your request, we have completed a Geotechnical Engineering Investigation for the above-referenced site. The results of our investigation are presented in the attached report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 348-2200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

REGISTERED PROFESSIONAL ENGINEER
DAVID R. JAROSZ II
2698
GEOTECHNICAL
STATE OF CALIFORNIA

David R. Jarosz, II
Managing Engineer
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DRJ:ht

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November 20, 2024 KA Project No. 012-24185

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED MERCED CITY SCHOOL DISTRICT
OPERATINONIAL SUPPORT SERVICES CENTER
2600 'K' STREET
MERCED, CALIFORNIA

INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed Merced City School District new programming building to be located at 2600 'K' Street in Merced, California. Discussions regarding site conditions are presented herein, together with conclusions and recommendations pertaining to site preparation, Engineered Fill, utility trench backfill, drainage and landscaping, foundations, concrete floor slabs and exterior flatwork, retaining walls, pavement design and soil cement reactivity.

A site plan showing the approximate boring locations is presented following the text of this report. A description of the field investigation, boring logs, and the boring log legend are presented in Appendix A. Appendix A contains a description of laboratory testing phase of this study along with laboratory test results. Appendices B and C contain guides to earthwork and pavement specifications. When conflicts in the text of the report occur with the general specifications in the appendices, the recommendations in the text of the report have precedence.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the soil and groundwater conditions at the site, to make geotechnical engineering recommendations for use in design of specific construction elements, and to provide criteria for site preparation and Engineered Fill construction.

Our scope of services was outlined in our proposal dated September 11, 2024 (KA Proposal No. P659-24) and included the following:

- A site reconnaissance by a member of our engineering staff to evaluate the surface conditions at the project site.
- A field investigation consisting of drilling 3 borings to depths ranging from approximately 10 to 50 feet for evaluation of the subsurface conditions at the project site.
- Performing laboratory tests on representative soil samples obtained from the borings to evaluate the physical and index properties of the subsurface soils.

- Evaluation of the data obtained from the investigation and an engineering analysis to provide recommendations for use in the project design and preparation of construction specifications.

- Preparation of this report summarizing the results, conclusions, recommendations and findings of our investigation.

PROPOSED CONSTRUCTION

We understand that design of the proposed development is currently underway; structural load information and other final details pertaining to the structures are unavailable. On a preliminary basis, it is understood the planned development will include the construction of a new programming building. It is anticipated the building will be a single- or two-story structure supported on shallow conventional foundations utilizing concrete slab-on-grade construction. Footing loads are anticipated to be light to moderate. On-site paved areas and landscaping are also planned for the development of the project.

In the event these structural or grading details are inconsistent with the final design criteria, the Soils Engineer should be notified so that we may update this writing as applicable.

SITE LOCATION AND SITE DESCRIPTION

The site is rectangular in shape and encompasses approximately ¾ acre. The site is located at the northeast corner of 'K' Street and W. 26th Street in Merced. The site has a street address of 2600 'K' Street. Residential developments are located east and west of the site. A church and residential developments are located to the north. A school is located south of the site.

An existing metal building with a parking lot is located on the site. The building is located in the central portion of the site. Small bushes are located within the planter areas around the building. Portions of the site are covered by a sparse to moderate weed and grass growth and the surface soils have a loose consistency. Overhead electric lines are located along the northern edge of the site. A concrete pad is located on the northeast corner of the building. Concrete curb, gutter and sidewalk are located along the southern and western edges of the site. Underground utilities, including gas, sewer and water are located within the site. The site is relatively level with no major changes in grade.

GEOLOGIC SETTING

The San Joaquin Valley, which includes the Merced area, is a topographic and structural basin that is bounded on the east by the Sierra Nevada Mountains and on the west by the Coast Ranges. The Sierra Nevada, a fault block dipping gently southwestward, is made up of igneous and metamorphic rocks of pre-Tertiary age that comprise the basement complex beneath the Valley. The Coast Ranges contain folded and faulted sedimentary rocks of Mesozoic and Cenozoic age, which are similar to those rocks that underlie the Valley at depth and non-conformably overlie the basement complex; gently dipping to nearly horizontal sedimentary rocks of Tertiary and Quaternary age overlie the older rocks. These younger rocks are mostly of continental origin and in the Merced area, they were derived from the Sierra Nevada.

The Coast Ranges evolved as a result of folding, faulting, and accretion of diverse geologic terrains. They are composed chiefly of sedimentary and metamorphic rocks that are sharply deformed into complex structures. They are broken by numerous faults, the San Andreas Fault being the most notable structural feature.

Both the Sierra Nevada and Coast Range are geologically young mountain ranges and possess active and potentially active fault zones. Major active faults and fault zones occur at some distance to the east, west, and south of the Merced area. The Owens Valley Fault Zone bounds the eastern edge of the Sierra Nevada block and contains both active and potentially active faults.

There are no active fault traces in the project vicinity. Accordingly, the project area is not within an Earthquake Fault Zone (Special Studies Zone) and will not require a special site investigation by an Engineering Geologist.

Merced residents could feel the effects of a large seismic event on one of the nearby active or potentially active fault zones. Merced has experienced groundshaking from earthquakes in the historical past. According to the Five County Seismic Safety Element, groundshaking of VII intensity (Modified Mercali Scale) was felt in Merced from the 1872 Owens Valley Earthquake. This is the largest known earthquake event affecting the Merced area.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface soil conditions were explored by drilling 3 borings to depths ranging from approximately 10 to 50 feet below existing site grade, using a truck-mounted drill rig. In addition, 1 bulk subgrade sample was obtained from the site for laboratory R-value testing. The approximate boring and bulk sample locations are shown on the site plan. During drilling operations, penetration tests were performed at regular intervals to evaluate the soil consistency and to obtain information regarding the engineering properties of the subsoils. Soil samples were retained for laboratory testing. The soils encountered were continuously examined and visually classified in accordance with the Unified Soil Classification System. A more detailed description of the field investigation is presented in Appendix A.

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory testing program was formulated with emphasis on the evaluation of natural moisture, density, gradation, shear strength, consolidation potential, expansion potential, plasticity, R-value, and moisture-density relationships of the materials encountered. In addition, chemical tests were performed to evaluate the soil-cement reactivity. Details of the laboratory test program and the results of the laboratory tests are summarized in Appendix A. This information, along with the field observations, was used to prepare the final boring logs in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings, the subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the pavement section consisted of approximately 3 inches of asphaltic concrete paving.

Beneath the pavement section, approximately 1 to 2½ feet of fill material was encountered within the site. The fill material predominately consisted of silty sand. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. The limited testing indicates that the fill soils ranged from loosely placed to compacted.

Below the fill, approximately 2 to 4 feet of firm to stiff sandy clay and sandy clay with gravel were encountered. Field and laboratory tests suggest that these soils have moderate strength characteristics, slightly compressible and have a moderate expansion potential. Penetration resistance ranged from 9 to 11 blows per foot. Dry densities ranged from 110 to 113 pcf. Representative soil samples consolidated approximately 2 and 2½ percent under a 2 ksf load when saturated. A representative soil sample had an internal angle of friction of 23 degrees. A representative soil sample had an expansion index of 77.

Below 4 to 5 feet, predominately medium dense to very dense, silty sand, silty sand/sandy silt and sandy clayey silt or stiff to hard sandy clay were encountered. Field and laboratory tests suggest that these soils are moderately strong and slightly compressible. Penetration resistance ranged from 18 to 64 blows per foot. Dry densities ranged from 75 to 112 pcf. These soils had similar strength characteristics to the upper soils and extended to the termination depth of our borings.

For additional information about the soils encountered, please refer to the logs of borings in Appendix A.

GROUNDWATER

Test boring locations were checked for the presence of groundwater during and immediately following the drilling operations. Free groundwater was not encountered within a depth of 50 feet. However, historical groundwater has been as shallow as 7 feet within the project site vicinity.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

SOIL LIQUEFACTION

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic event.

To evaluate the liquefaction potential of the site, the following items were evaluated:

1) Soil type

2) Groundwater depth

3) Relative density

4) Initial confining pressure

5) Intensity and duration of groundshaking

The predominant soils within the project site consist of alternating layers of sandy clay, silty sand/sandy silt, sandy clayey silt and silty sand. Groundwater was not encountered within a depth of 50 feet during our exploratory drilling. However, information obtained from the Department of Water Resources indicates that water wells had historic water elevations as shallow as 7 feet below site grade within the project site vicinity.

The potential for soil liquefaction during a seismic event was evaluated using the LIQUEFYPRO computer program (version 5.9d) developed by CivilTech Software. For the analysis, a maximum earthquake magnitude of 8.27 was used. A peak horizontal ground surface acceleration of 0.32g was considered conservative and appropriate for the liquefaction analysis. An estimated high groundwater depth of 7 feet was used for our analysis. The analysis indicates that the on-site soils have a low potential of liquefaction under seismic shaking. The analysis indicates that the total and differential seismic induced settlement is not anticipated to exceed 1½ and 1 inch, respectively. The differential settlement is estimated over a horizontal distance of 100 feet.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of our field and laboratory investigations, along with previous geotechnical experience in the project area, the following is a summary of our evaluations, conclusions and recommendations.

Administrative Summary

In brief, the subject site and soil conditions, with the exception of the loose surface soils, fill material, existing development, and expansive nature of the clayey soils, appear to be conducive to the development of the project. The surface soils have a loose consistency. These soils are disturbed, have low strength characteristics, and are highly compressible when saturated. Accordingly, it is recommended that the surface soils be recompacted. The intent is to stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation.

Approximately 1 to 2½ feet of fill material was encountered within the site. The fill material predominately consisted of silty sand. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. The limited testing indicates the fill soils had varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that fill soils be completely removed so the native soils can be prepared properly. Over-excavation should extend to a minimum of 5 feet beyond structural elements. The fill

material will be suitable for reuse as Engineered Fill, provided it is cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Supplemental testing will be required during grading to verify the suitability for re-use as non-expansive Engineered Fill.

The site presently consists of a metal building and parking lot. In addition, the site is surrounded by existing developments. Associated with these developments are buried structures, such as utility lines and landscape irrigation lines that may extend into the project site. Demolition activities should include proper removal of any buried structures. Any surface or buried structures encountered during construction should be properly removed and/or relocated. It is suspected that demolition activities of the existing structures will disturb the upper soils. After demolition activities, it is recommended that these disturbed soils be removed and/or recompacted. This compaction effort should stabilize the upper soils and locate any unsuitable or pliant areas not found during our field investigation.

Clayey soils were encountered within the site. These clayey soils appear to have a moderate shrink/swell potential. The estimated swell pressure of the clayey material may cause movement affecting slabs and brittle exterior finishes. To reduce the potential soil movement, it is recommended that the upper 24 inches of soil within slab-on-grade and exterior flatwork areas consist of non-expansive fill. The fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A sandy soil will allow the surface water to drain into the expansive clayey soils below, which may result in swelling. The replacement soil and/or the upper 24 inches of Imported Fill soils should meet the specifications as described under the subheading Engineered Fill. The replacement soils should extend 5 feet beyond the perimeter of the building. The non-expansive replacement soil should be compacted to at least 90 percent relative compaction based on ASTM Test Method D1557. The exposed native soils in the excavation should not be allowed to dry out and should be kept continuously moist prior to backfilling. In addition, it is recommended that slabs-on-grade continuous footings and slabs be nominally reinforced to reduce cracking and vertical off-set.

As an alternative to the use of non-expansive soils, the upper 24 inches of soil supporting the slab-on-grade and exterior flatwork areas can consist of lime-treated clayey soils. The lime-treated soils should be recompacted to a minimum of 90 percent of maximum density. Preliminary application rate of lime should be 5 percent by dry weight. The lime material should be calcium oxide, commonly known as quick-lime. The clayey soils should be at or near optimum moisture during the mixing operations. An acceptable alternate section consists of 18 inches of lime-treated clayey soils overlain by 6 inches of Class 2 aggregate base.

It is recommended that any uncertified fill material encountered within pavement areas be removed and/or recompacted. The fill material should be moisture conditioned to near optimum moisture and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. As an alternative, the Owner may elect not to recompact the existing fill within paved areas. However, the Owner should be aware that the paved areas may settle, which may require annual maintenance. At a minimum, it is recommended that the upper 12 inches of subgrade soil be moisture-conditioned to minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Shrub root removal operations should include roots greater than 1 inch in diameter. The resulting excavation should be backfilled with Engineered Fill compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structure footings may be designed utilizing an allowable bearing pressure of 2,500 psf for dead-plus-live loads. Footings should have a minimum embedment of 18 inches.

Groundwater Influence on Structures/Construction

Based on our findings and historical records, it is not anticipated that groundwater will rise within the zone of structural influence or affect the construction of foundations or pavements for the project. However, if earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated, "pump," or not respond to densification techniques. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material; or mixing the soil with an approved lime or cement product. Our firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Site Preparation

General site clearing should include removal of vegetation, existing utilities, structures including foundations, basement walls and floors, existing stockpiled soil, trees and associated root systems, rubble, rubbish, and any loose and/or saturated materials. Site stripping should extend to a minimum depth of 2 to 4 inches, or until all organics in excess of 3 percent by volume are removed. Deeper stripping may be required in localized areas. These materials will not be suitable for use as Engineered Fill. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas.

Approximately 1 to 2½ feet of fill material was encountered within the site. The fill material predominately consisted of silty sand. The thickness and extent of fill material was determined based on limited test borings and visual observation. Thicker fill may be present at the site. Limited testing was performed on the fill soils during the time of our field and laboratory investigations. The limited testing indicates the fill soils had varying strength characteristics ranging from loosely placed to compacted. Therefore, it is recommended that fill soils be completely removed so the native soils can be prepared properly. Over-excavation should extend to a minimum of 5 feet beyond structural elements. The fill material will be suitable for reuse as Engineered Fill, provided it is cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension. Supplemental testing will be required during grading to verify the suitability for re-use as non-expansive Engineered Fill.

The site presently consists of a metal building with associated landscape and pavements. Associated with these developments are buried structures, such as utility lines and landscape irrigation lines that may extend into the project site. Any surface or buried structures, including utilities, encountered during construction should be properly removed and the resulting excavations backfilled with Engineered Fill. It is suspected demolition activities of the existing structures will disturb the upper soils. Areas disturbed by demolition activities should be excavated to firm native ground. Excavations, depressions,

or soft and pliant areas extending below planned finished subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill. In general, any septic tanks, debris pits, cesspools, or similar structures should be entirely removed. Concrete footings should be removed to an equivalent depth of at least 3 feet below proposed footing elevations or as recommended by the Soils Engineer. Any other buried structures encountered should be removed in accordance with the recommendations of the Soils Engineer. The resulting excavations should be backfilled with Engineered Fill.

Shrubs are located within portions of the site. Shrub removal operations should include roots greater than 1 inch in diameter. The resulting excavations should be backfilled with Engineered Fill compacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Following stripping, fill removal operations and demolition activities, and prior to fill placement, the exposed subgrade in building pad areas should be excavated to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Within pavement and exterior flatwork areas, following stripping, demolition, and fill removal activities, the exposed subgrade should be excavated/scarified to a depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to a minimum of 2 percent above optimum moisture content, and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. Prior to backfilling, the exposed subgrade should be proof-rolled to verify stability. This compaction effort should stabilize the surface soils and locate any unsuitable or pliant areas not found during our field investigation. Soft or pliant areas encountered should be excavated to firm native ground. Limits of recompaction should extend a minimum of 5 feet beyond buildings and 2 feet beyond flatwork and pavements.

It is recommended that the upper 24 inches of soil within proposed conventional slab-on-grade and exterior flatwork areas consist of non-expansive Engineered Fill or lime-treated Engineered Fill. The intent is to support the slab-on-grade areas with 24 inches of non-expansive or lime-treated fill. The fill placement serves two functions: 1) it provides a uniform amount of soil which will more evenly distribute the soil pressures and 2) it reduces moisture content fluctuation in the clayey material beneath the building area. The non-expansive fill material should be a well-graded silty sand or sandy silt soil. A clean sand or very sandy soil is not acceptable for this purpose. A sandy soil will allow the surface water to drain into the expansive clayey soil below, which may result in soil swelling. Imported Fill should be approved by the Soils Engineer prior to placement. The fill should be placed as specified as Engineered Fill.

It is recommended that any uncertified fill material encountered within pavement areas be removed and/or recompacted. The fill material should be moisture-conditioned to a minimum of 2 percent above optimum moisture and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. As an alternative, the Owner may elect not to recompact the existing fill within paved areas. However, the Owner should be aware that the paved areas may settle which may require annual maintenance. At a minimum, it is recommended that the upper 12 inches of subgrade soil be moisture-conditioned to a minimum of 2 percent above optimum moisture content and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

The upper soils, during wet winter months become very moist due to the absorptive characteristics of the soil. Earthwork operations performed during winter months may encounter very moist unstable soils, which may require removal to grade a stable building foundation. Project site winterization consisting of placement of aggregate base and protecting exposed soils during the construction phase should be performed.

A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Soils Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section and the Engineered Fill section.

Engineered Fill

The organic-free, on-site, upper native and fill soils are predominately silty sand, sandy clay and sandy clay with gravel. The clayey soils will not be suitable for reuse as non-expansive Engineered Fill. The clayey soils will be suitable for reuse for fill placement within the upper 24 inches of slab-on-grade and exterior flatwork areas, provided they are lime-treated. The preliminary application rate of lime should be 5 percent by dry weight. The lime material should be calcium oxide, commonly known as quick-lime. The clayey soils should be at or near optimum moisture during mixing operations. Additional testing is recommended to determine the appropriate application rate of lime prior to placement. These clayey soils will be suitable for reuse as General Engineered Fill, within pavement areas and below 24 inches from finished pad grade in building areas, provided they are cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension and moisture-conditioned to at least 2 percent above optimum moisture. Silty sand soils with an expansion index of 15 or less will be suitable for re-use as non-expansive Engineered Fill, provided they are cleansed of excessive organics and debris. The asphaltic concrete will not be suitable for reuse as Engineered Fill within the proposed building pad. However, fill intermixed with asphaltic concrete may be used in the paved areas, provided it is cleansed of excessive organics, debris, and fragments larger than 4 inches in maximum dimension and blended into the fill.

The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since he has complete control of the project site at that time.

Imported Fill should consist of a well-graded, slightly cohesive, fine silty sand or sandy silt soil, with relatively impervious characteristics when compacted. This material should be approved by the Soils Engineer prior to use and should typically possess the following characteristics:

Percent Passing No. 200 Sieve	20 to 50
Plasticity Index	10 maximum
UBC Standard 29-2 Expansion Index	15 maximum

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned to a minimum of 2 percent above optimum moisture content and compacted to achieve at least 90 percent of the maximum density based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

Drainage and Landscaping

The ground surface should slope away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices. In accordance with Section 1804 of the 2022 California Building Code, it is recommended that the ground surface adjacent to foundations be sloped a minimum of 5 percent for a minimum distance of 10 feet away from structures, or to an approved alternative means of drainage conveyance. Swales used for conveyance of drainage and located within 10 feet of foundations should be sloped a minimum of 2 percent. Impervious surfaces, such as pavement and exterior concrete flatwork, within 10 feet of building foundations should be sloped a minimum of 1 percent away from the structure. Drainage gradients should be maintained to carry all surface water to collection facilities and off-site. These grades should be maintained for the life of the project.

Slots or weep holes should be placed in drop inlets or other surface drainage devices in pavement areas to allow free drainage of adjoining base course materials. Cutoff walls should be installed at pavement edges adjacent to vehicular traffic areas; these walls should extend to a minimum depth of 12 inches below pavement subgrades to limit the amount of seepage water that can infiltrate the pavements. Where cutoff walls are undesirable, subgrade drains can be constructed to transport excess water away from planters to drainage interceptors. If cutoff walls can be successfully used at the site, construction of subgrade drains is considered unnecessary.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards by a Contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the Contractor. Traffic and vibration adjacent to trench walls should be reduced and cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced especially during or shortly following periods of precipitation.

Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 90 percent of maximum density based on ASTM Test Method D1557. Utility trench backfill placed in pavement areas should be compacted to at least 90 percent of maximum density based on ASTM Test Method D1557. Pipe bedding should be in accordance with pipe manufacturer's recommendations.

Sandy and gravelly soil conditions were encountered at the site. These cohesionless soils have a tendency to cave in trench wall excavations. Shoring or sloping back trench sidewalls may be required within these sandy and gravelly soils.

The Contractor is responsible for removing all water sensitive settlement from the trench regardless of the backfill location and compaction requirements. The Contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

Foundations - Conventional

After completion of the recommended site preparation, the site should be suitable for shallow footing support. The proposed structures may be supported on a shallow foundation system bearing on undisturbed native soils or Engineered Fill. Spread and continuous footings can be designed for the following maximum allowable soil bearing pressures:

Load	Allowable Loading
Dead Load Only	1,875 psf
Dead-Plus-Live Load	2,500 psf
Total Load, Including Wind or Seismic Loads	3,325 psf

Footings should have a minimum depth of 18 inches. Footings should have a minimum width of 12 inches, regardless of load. Depths cited should be measured from rough grade or exterior grade, whichever is lower.

The footing excavations should not be allowed to dry out any time prior to pouring concrete. It is recommended that footings be reinforced by at least one No. 4 reinforcing bar in both top and bottom.

The total movement associated with static loads is not expected to exceed 1 inch. Differential movement associated with static loads measured across a horizontal distance of 20 feet or between column footings should be less than ½ inch. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction movement may occur if the foundation soils are flooded or saturated. The total and differential seismic-induced settlement is estimated to be less than 1½ inches and 1 inch, respectively. The anticipated differential settlement is estimated over a horizontal distance of 100 feet.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.30 acting between the base of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot acting against the appropriate vertical footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. A ⅓ increase in the above value may be used for short duration, wind, or seismic loads.

Floor Slabs and Exterior Flatwork

Concrete slab-on-grade floors should be underlain by a water vapor retarder. The water vapor retarder should be installed in accordance with accepted engineering practice. The water vapor retarder should consist of a vapor retarder sheeting underlain by a minimum of 3 inches of compacted, clean, gravel of ¾-inch maximum size. To aid in concrete curing an optional 2 to 4 inches of granular fill may be placed on top of the vapor retarder. The granular fill should consist of damp clean sand with at least 10 to 30 percent of the sand passing the 100 sieve. The sand should be free of clay, silt, or organic material. Rock dust which is manufactured sand from rock crushing operations is typically suitable for the granular fill. This granular fill material should be compacted.

It is recommended that the concrete slab be reinforced to reduce crack separation and possible vertical offset at the cracks. We recommend at least No. 3 reinforcing bars placed on 18-inch centers, be used for this purpose. The reinforcement should be placed at mid-height within the slab. Thicker floor slabs with increased concrete strength and reinforcement should be designed wherever heavy concentrated loads, heavy equipment, or machinery is anticipated.

The exterior floors should be poured separately in order to act independently of the walls and foundation system. Exterior finish grades should be sloped a minimum of 2 percent away from all interior slab areas to preclude ponding of water adjacent to the structures. All fills required to bring the building pads to grade should be Engineered Fills.

Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor can travel through the vapor membrane and penetrate the slab-on-grade. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To reduce moisture vapor intrusion, it is recommended that a vapor retarder be installed. It is recommended that the utility trenches within the structure be compacted, as specified in our report, to reduce the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the building is recommended. Positive drainage should be established away from the structure and should be maintained throughout the life of the structure. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed. In addition, ventilation of the structure (i.e. ventilation fans) is recommended to reduce the accumulation of interior moisture.

Lateral Earth Pressures and Retaining Walls

Walls retaining horizontal backfill and capable of deflecting a minimum of 0.1 percent of its height at the top may be designed using an equivalent fluid active pressure of 50 pounds per square foot per foot of depth. Walls incapable of this deflection or are fully constrained walls against deflection may be designed for an equivalent fluid at-rest pressure of 70 pounds per square foot per foot of depth. Expansive soils should not be used for backfill against walls. The wedge of non-expansive backfill material should extend from the bottom of each retaining wall outward and upward at a slope of 2:1 (horizontal to vertical) or flatter. The stated lateral earth pressures do not include the effects of hydrostatic water pressures generated by infiltrating surface water that may accumulate behind the retaining walls; or loads imposed by construction equipment, foundations, or roadways.

Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic concrete, or other suitable backfill to reduce surface drainage into the wall drain system. The aggregate should conform to Class 2 permeable materials graded in accordance with CalTrans Standard Specifications (2018). Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel, provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The pipes should be placed no higher than 6 inches above the heel of the wall, in the center line of the drainage blanket and should have a minimum diameter of four inches. Collector pipes may be either slotted or perforated. Slots should be no wider than ⅛ inch in diameter, while perforations should be no more than ¼ inch in diameter. If retaining walls are less than 6 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 4-inch diameter holes (concrete walls) or unmortared head joints (masonry walls) and not be higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand-operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

R-Value Test Results and Pavement Design

One subgrade soil sample was obtained from the project site for R-value testing at the location shown on the attached site plan. The sample was tested in accordance with the State of California Materials Manual Test Designation 301. The result of the test is as follows:

Sample	Depth	Description	R-Value at Equilibrium
1	12-24"	Sandy Clay (CL)	Less than 5

The test result is low and indicates poor subgrade support characteristics under dynamic traffic loads. The following table shows the recommended pavement sections for various traffic indices.

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Class III Aggregate Subbase	Compacted Subgrade**
4.0	2.0"	8.5"	--	12.0"
4.0	2.0"	4.5"	4.5"	12.0"
4.5	3.0"	9.0"	--	12.0"
4.5	3.0"	4.0"	5.5"	12.0"
5.0	3.0"	11.0"	--	12.0"
5.0	3.0"	5.0"	6.5"	12.0"
5.5	3.0"	11.5"	--	12.0"
5.5	3.0"	5.0"	7.0"	12.0"
6.0	3.0"	13.5"	--	12.0"
6.0	3.0"	6.5"	8.0"	12.0"
6.5	3.5"	14.0"	--	12.0"
6.5	3.5"	6.0"	9.0"	12.0"
7.0	4.0"	15.5"	--	12.0"
7.0	4.0"	6.5"	10.0"	12.0"
7.5	4.0"	17.0"	--	12.0"
7.5	4.0"	7.5"	10.5"	12.0"

**** 95% compaction based on ASTM Test Method D1557 or CAL 216***
***** 90% compaction based on ASTM Test Method D1557 or CAL 216***

If traffic indices are not available, an estimated (typical value) index of 4.5 may be used for light automobile traffic, and an index of 7.0 may be used for light truck traffic.

The following recommendations are for light-duty and heavy-duty Portland Cement Concrete Pavement Sections based on the design procedures developed by the Portland Cement Association.

PORTLAND CEMENT PAVEMENT
LIGHT DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
4.5	6.0"	5.0"	12.0"

HEAVY DUTY

Traffic Index	Portland Cement Concrete***	Class II Aggregate Base*	Compacted Subgrade**
7.0	7.0"	6.0"	12.0"

** 95% compaction based on ASTM Test Method D1557 or CAL 216*
*** 90% compaction based on ASTM Test Method D1557 or CAL 216*
****Minimum Compressive Strength of 3000 psi*

As indicated previously, fill material is located on the site. It is recommended that any uncertified fill material encountered within pavement areas be removed and/or recompacted. The fill material should be moisture-conditioned to near optimum moisture and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557. As an alternative, the Owner may elect not to recompact the existing fill within paved areas. However, the Owner should be aware that the paved areas may settle which may require annual maintenance. At a minimum, it is recommended that the upper 12 inches of subgrade soil be moisture-conditioned as necessary and recompacted to a minimum of 90 percent of maximum density based on ASTM Test Method D1557.

Seismic Parameters – 2022 California Building Code

The Site Class per Section 1613 of the 2022 California Building Code (2022 CBC) and ASCE 7-16, Chapter 20 is based upon the site soil conditions. It is our opinion that a Site Class D is most consistent with the subject site soil conditions. For seismic design of the structures based on the seismic provisions of the 2022 CBC, we recommend the following parameters:

Seismic Item	Value	CBC Reference
Site Class	D	Section 1613.2.2
Site Coefficient F_a	1.357	Table 1613.2.3 (1)
S_s	0.554	Section 1613.2.1
S_{MS}	0.752	Section 1613.2.3
S_{DS}	0.501	Section 1613.2.4
Site Coefficient F_v	2.136	Table 1613.2.3 (2)
S_1	0.232	Section 1613.2.1
S_{M1}	0.496	Section 1613.2.3
S_{D1}	0.330	Section 1613.2.4
T_S	0.659	Section 1613.2

* Based on Equivalent Lateral Force (ELF) Design Procedure being used.

Soil Cement Reactivity

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete (or stucco) and the soil. HUD/FHA and CBC have developed criteria for evaluation of sulfate levels and how they relate to cement reactivity with soil and/or water.

Soil samples were obtained from the site and tested in accordance with State of California Materials Manual Test Designation 417. The sulfate concentrations detected from these soil samples were less than 150 ppm and are below the maximum allowable values established by HUD/FHA and CBC. Therefore, no special design requirements are necessary to compensate for sulfate reactivity with the cement.

Compacted Material Acceptance

Compaction specifications are not the only criteria for acceptance of the site grading or other such activities. The compaction test is the most universally recognized test method for assessing the performance of the Grading Contractor. The numerical test results from the compaction test cannot be used to predict the engineering performance of the compacted material. Therefore, the acceptance of compacted materials will also be dependent on the stability of that material. The Soils Engineer has the option of rejecting any compacted material regardless of the degree of compaction if that material is considered to be unstable or if future instability is suspected. A specific example of rejection of fill material passing the required percent compaction is a fill which has been compacted with an in-situ moisture content significantly less than optimum moisture. This type of dry fill (brittle fill) is susceptible to future settlement if it becomes saturated or flooded.

Testing and Inspection

A representative of Krazan & Associates, Inc., should be present at the site during the earthwork activities to confirm that actual subsurface conditions are consistent with the exploratory fieldwork. This activity is an integral part of our services as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction. Krazan & Associates, Inc., will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor.

LIMITATIONS

Soils Engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences improve. Although your site was analyzed using the most appropriate current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to improvements in the field of Soils Engineering, physical changes in the site either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the time of completion of the soils report, may require the soils report to be professionally reviewed. In light of this, the Owner should be

aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that 2 years be considered a reasonable time for the usefulness of this report.

Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. If any variations or undesirable conditions are encountered during construction, the Soils Engineer should be notified so that supplemental recommendations can be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The Soils Engineer should be notified of any changes so the recommendations can be reviewed and re-evaluated.

This report is a Geotechnical Engineering Investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any environmental site assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater or atmosphere, or the presence of wetlands. Any statements or absence of statements in this report or on any boring log regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical data presented herewith is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such data and interpretation cannot be superseded by future geotechnical developments. We emphasize that this report is valid for this project as outlined above and should not be used for any other site.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 348-2200.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Steve Nelson
Project Engineer



David R. Jarosz, II
Managing Engineer
RCE No. 60185/RGE No. 2698

SN/DRJ:ht



APPROXIMATE BORING LOCATION

APPROXIMATE R-VALUE LOCATION

SITE MAP	**Scale:** NTS	**Date:** November 2024	Krazan GEOTECHNICAL ENGINEERING
New Programming Building **2600 'K' Street** **Merced, California**	**Drawn by:** HT	**Approved by:** DJ	
	Project No. 012-24185	**Figure No.** 1	

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. Three 4½-inch to 6½-inch exploratory borings were advanced. The boring locations are shown on the site plan.

The soils encountered were logged in the field during the exploration and, with supplementary laboratory test data, are described in accordance with the Unified Soil Classification System.

Modified standard penetration tests and standard penetration tests were performed at selected depths. This test represents the resistance to driving a 2½-inch and 1½-inch diameter split barrel sampler, respectively. The driving energy was provided by a hammer weighing 140 pounds falling 30 inches. Relatively undisturbed soil samples were obtained while performing this test. Bag samples of the disturbed soil were obtained from the auger cuttings. The modified standard penetration tests are identified in the sample type on the boring logs with a full shaded in block. The standard penetration tests are identified in the sample type on the boring logs with half of the block shaded. All samples were returned to our Clovis laboratory for evaluation.

Laboratory Investigation

The laboratory investigation was programmed to determine the physical and mechanical properties of the foundation soil underlying the site. Test results were used as criteria for determining the engineering suitability of the surface and subsurface materials encountered.

In-situ moisture content, dry density, consolidation, direct shear, and sieve analysis tests were completed for the undisturbed samples representative of the subsurface material. Atterberg limits, expansion index and R-value tests were completed for select bag samples obtained from the auger cuttings. These tests, supplemented by visual observation, comprised the basis for our evaluation of the site material.

The logs of the exploratory borings and laboratory determinations are presented in this Appendix.

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

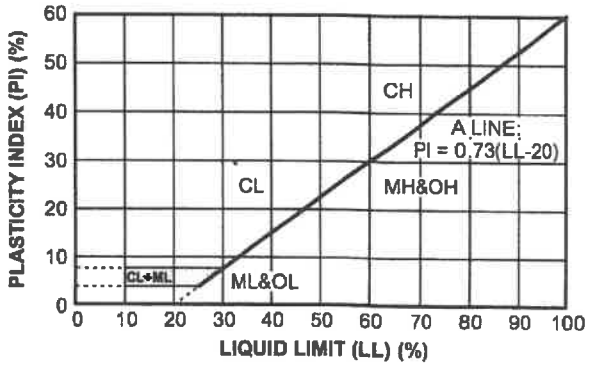
CONSISTENCY CLASSIFICATION

Description	Blows per Foot
Granular Soils	
Very Loose	< 5
Loose	5 – 15
Medium Dense	16 – 40
Dense	41 – 65
Very Dense	> 65
Cohesive Soils	
Very Soft	< 3
Soft	3 – 5
Firm	6 – 10
Stiff	11 – 20
Very Stiff	21 – 40
Hard	> 40

GRAIN SIZE CLASSIFICATION

Grain Type	*Standard Sieve Size*	*Grain Size in Millimeters*
Boulders	Above 12 inches	Above 305
Cobbles	12 to 13 inches	305 to 76.2
Gravel	3 inches to No. 4	76.2 to 4.76
Coarse-grained	3 to ¾ inches	76.2 to 19.1
Fine-grained	¾ inches to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
Coarse-grained	No. 4 to No. 10	4.76 to 2.00
Medium-grained	No. 10 to No. 40	2.00 to 0.42
Fine-grained	No. 40 to No. 200	0.42 to 0.074
Silt and Clay	Below No. 200	Below 0.074

PLASTICITY CHART



Log of Boring B1

Project: New Programming Building

Project No: 012-24185

Client: Merced City School District

Figure No.: A-1

Location: 2600 'K' Street, Merced, California

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
0		Ground Surface				
		ASPHALTIC CONCRETE = 3 inches				
		SILTY SAND (SM) FILL, fine- to medium-grained; dark brown, damp, drills easily				
2		***SANDY CLAY (CL)*** Firm, fine- to medium-grained with GRAVEL; brown, moist, drills easily	112.6	12.4		9
4						
6		***SANDY CLAY (CL)*** Hard, fine- to medium-grained; brown, moist, drills firmly	110.9	16.4		49
8						
10			104.4	19.6		43
12						
14		Very stiff below 15 feet				
16			96.3	20.8		18
18						
20						

Penetration Test blows/ft: 20, 40, 60

Water Content (%): 10, 20, 30, 40

Drill Method: Hollow Stem

Drill Rig: CME 45C-4

Driller: Jim Watts

Krazan and Associates

Drill Date: 10-25-24

Hole Size: 6½ Inches

Elevation: 50 Feet

Log of Boring B1

Project: New Programming Building | **Project No:** 012-24185

Client: Merced City School District | **Figure No.:** A-1

Location: 2600 'K' Street, Merced, California | **Logged By:** Dave Adams

Depth to Water> | **Initial:** None | **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.
22		***SILTY SAND/SANDY SILT (SM/ML)*** Medium dense, fine- to medium-grained; gray, moist, drills easily	109.0	16.0		18
24		***SILTY SAND (SM)*** Medium dense, fine- to medium-grained; brown, moist, drills easily				
26			105.7	13.9		18
28						
30			108.5	9.2		21
32		With trace GRAVEL below 32 feet				
34						
36		***SANDY CLAYEY SILT (ML)*** Medium dense, fine- to medium-grained; light brown, moist, drills easily	78.7	41.2		23
38						
40						

Penetration Test blows/ft: 20 40 60

Water Content (%): 10 20 30 40

Drill Method: Hollow Stem | **Drill Date:** 10-25-24

Drill Rig: CME 45C-4 | **Hole Size:** 6½ Inches

Driller: Jim Watts | **Elevation:** 50 Feet

Krazan and Associates

Log of Boring B1

Project: New Programming Building | **Project No:** 012-24185

Client: Merced City School District | **Figure No.:** A-1

Location: 2600 'K' Street, Merced, California | **Logged By:** Dave Adams

Depth to Water> | **Initial:** None | **At Completion:** None

Depth (ft)	Symbol	Description	Dry Density (pcf)	Moisture (%)	Type	Blows/ft.	Penetration Test blows/ft (20 40 60)	Water Content (%) (10 20 30 40)
42			74.8	43.7		28		■
44		***SANDY CLAY (CL)*** Very stiff, fine- to medium-grained; brown, moist, drills easily						
46			76.0	43.3		28		■
48								
50		End of Borehole						
52								
54								
56								
58								
60								

Drill Method: Hollow Stem | **Drill Date:** 10-25-24

Drill Rig: CME 45C-4 | **Krazan and Associates** | **Hole Size:** 6½ Inches

Driller: Jim Watts | **Elevation:** 50 Feet

Log of Boring B2

Project: New Programming Building

Project No: 012-24185

Client: Merced City School District

Figure No.: A-2

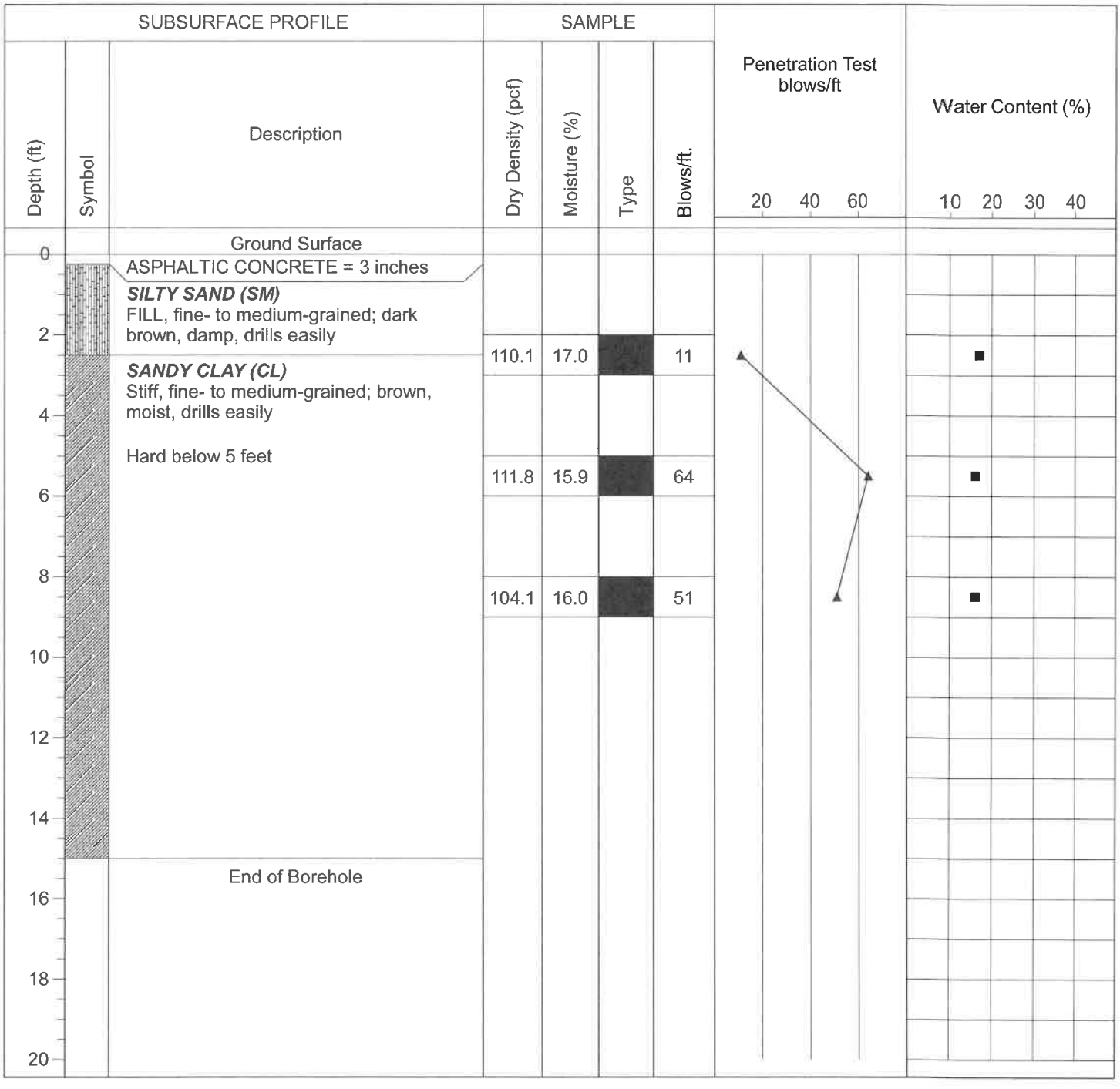
Location: 2600 'K' Street, Merced, California

Logged By: Dave Adams

Depth to Water>

Initial: None

At Completion: None



Drill Method: Solid Flight

Drill Date: 10-25-24

Drill Rig: CME 45C-4

Krazan and Associates

Hole Size: 4½ Inches

Driller: Jim Watts

Elevation: 15 Feet

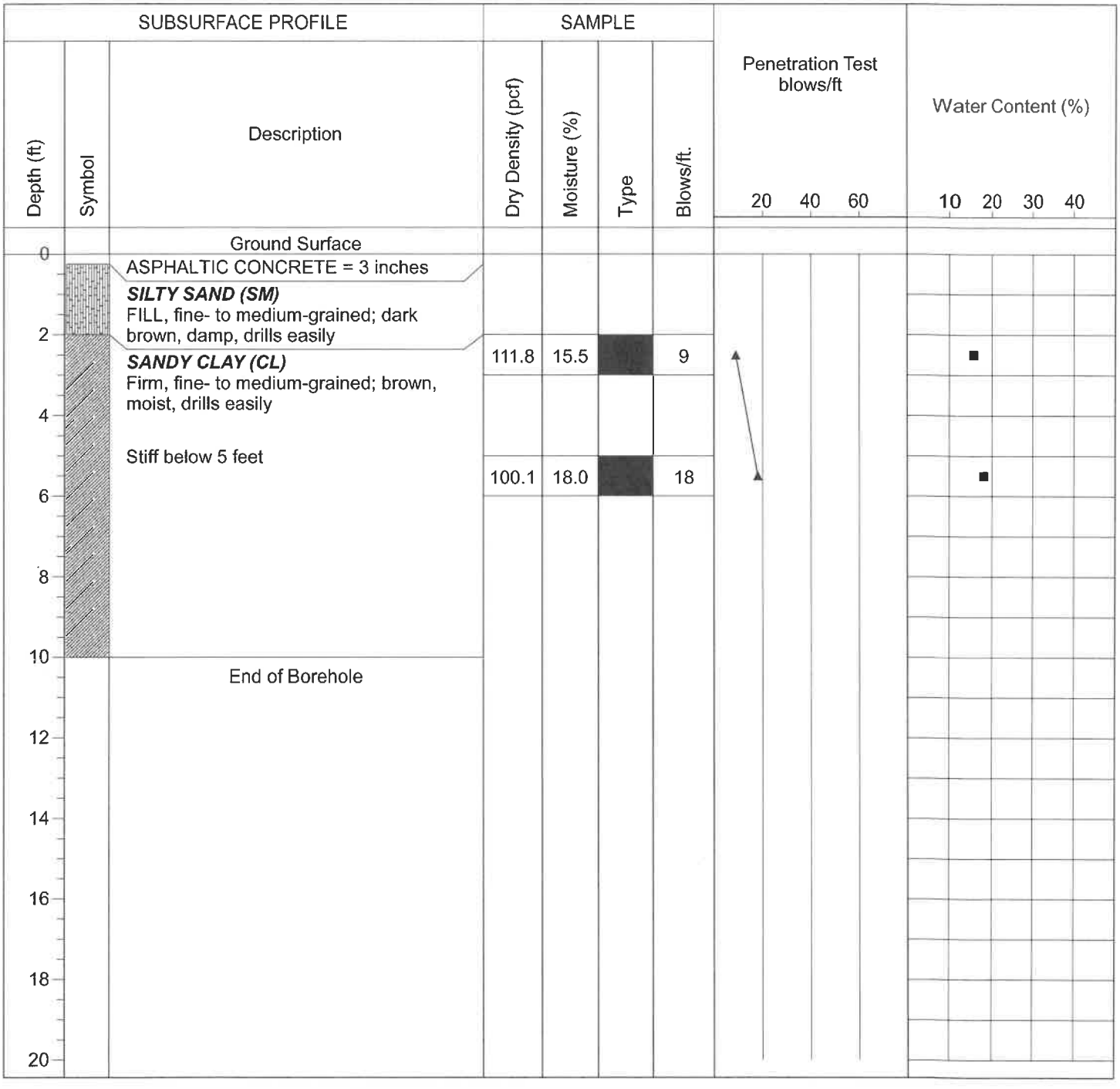
Log of Boring B3

Project: New Programming Building | **Project No:** 012-24185

Client: Merced City School District | **Figure No.:** A-3

Location: 2600 'K' Street, Merced, California | **Logged By:** Dave Adams

Depth to Water> | **Initial:** None | **At Completion:** None



Drill Method: Solid Flight | **Drill Date:** 10-25-24

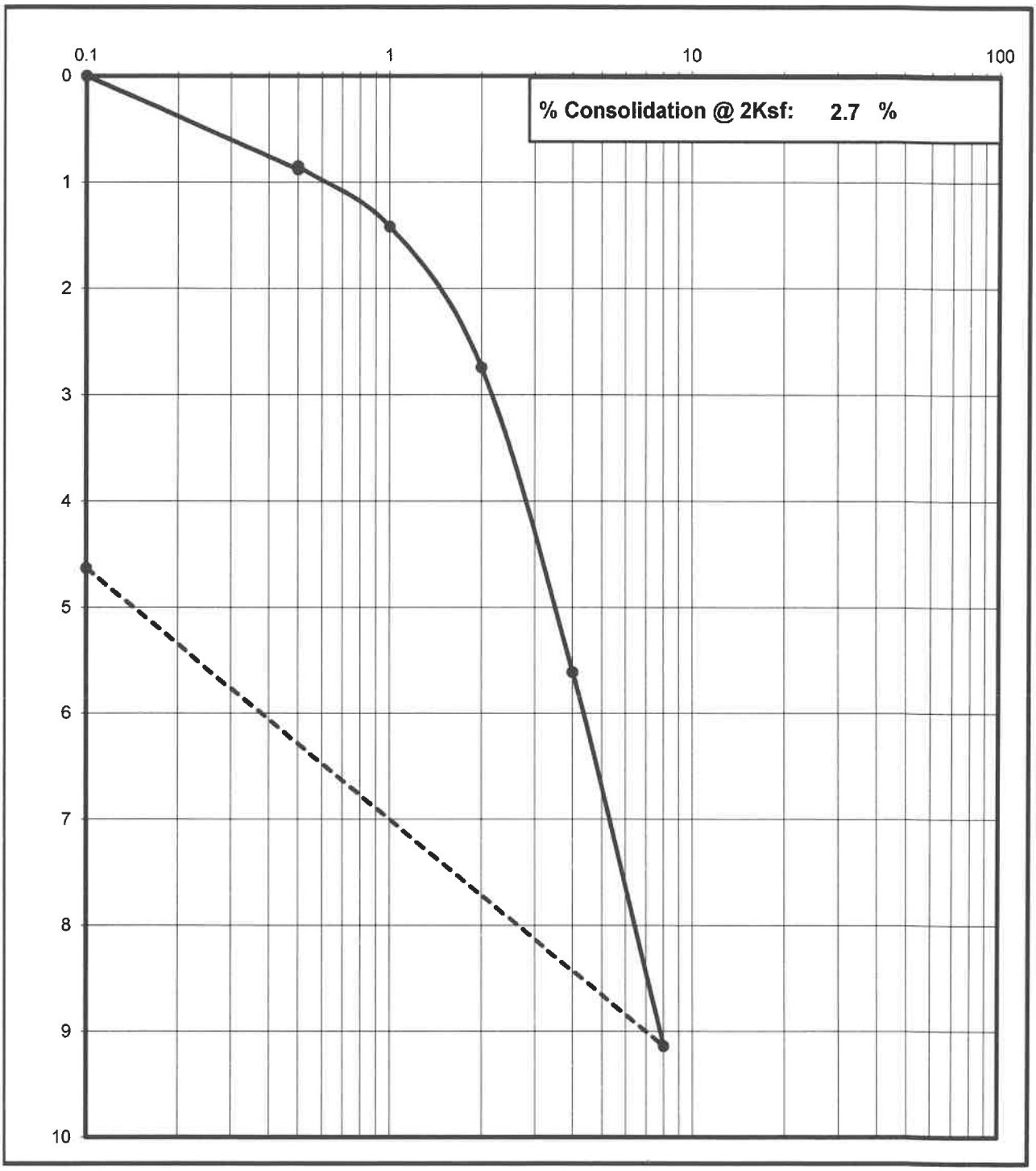
Drill Rig: CME 45C-4 | **Hole Size:** 4½ Inches

Driller: Jim Watts | **Elevation:** 10 Feet

Krazan and Associates

Consolidation Test

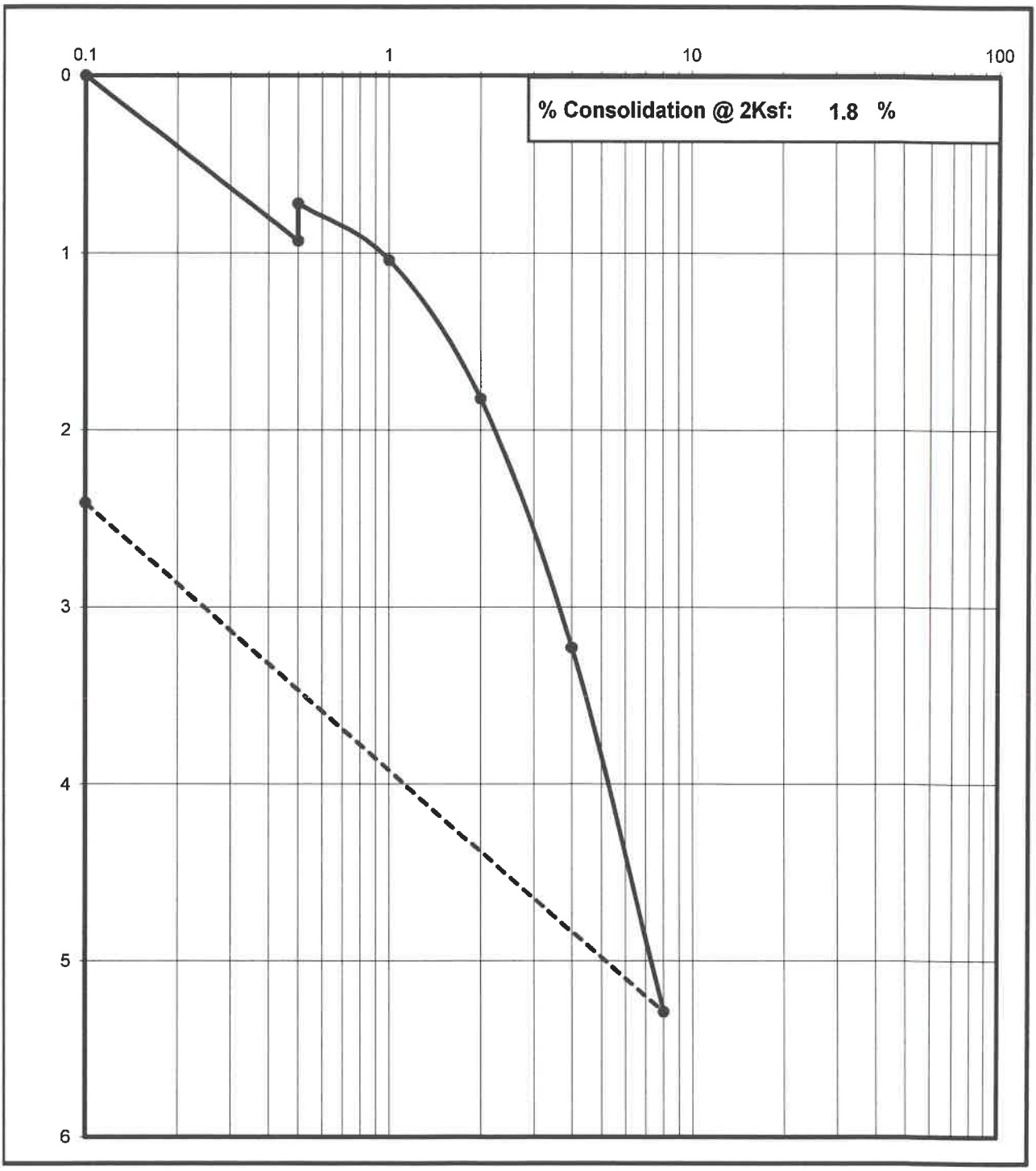
Project No	Boring No. & Depth	Date	Soil Classification
012-24185	B1 @ 2-3'	11/6/2024	CL w/ grvl



Krazan Testing Laboratory

Consolidation Test

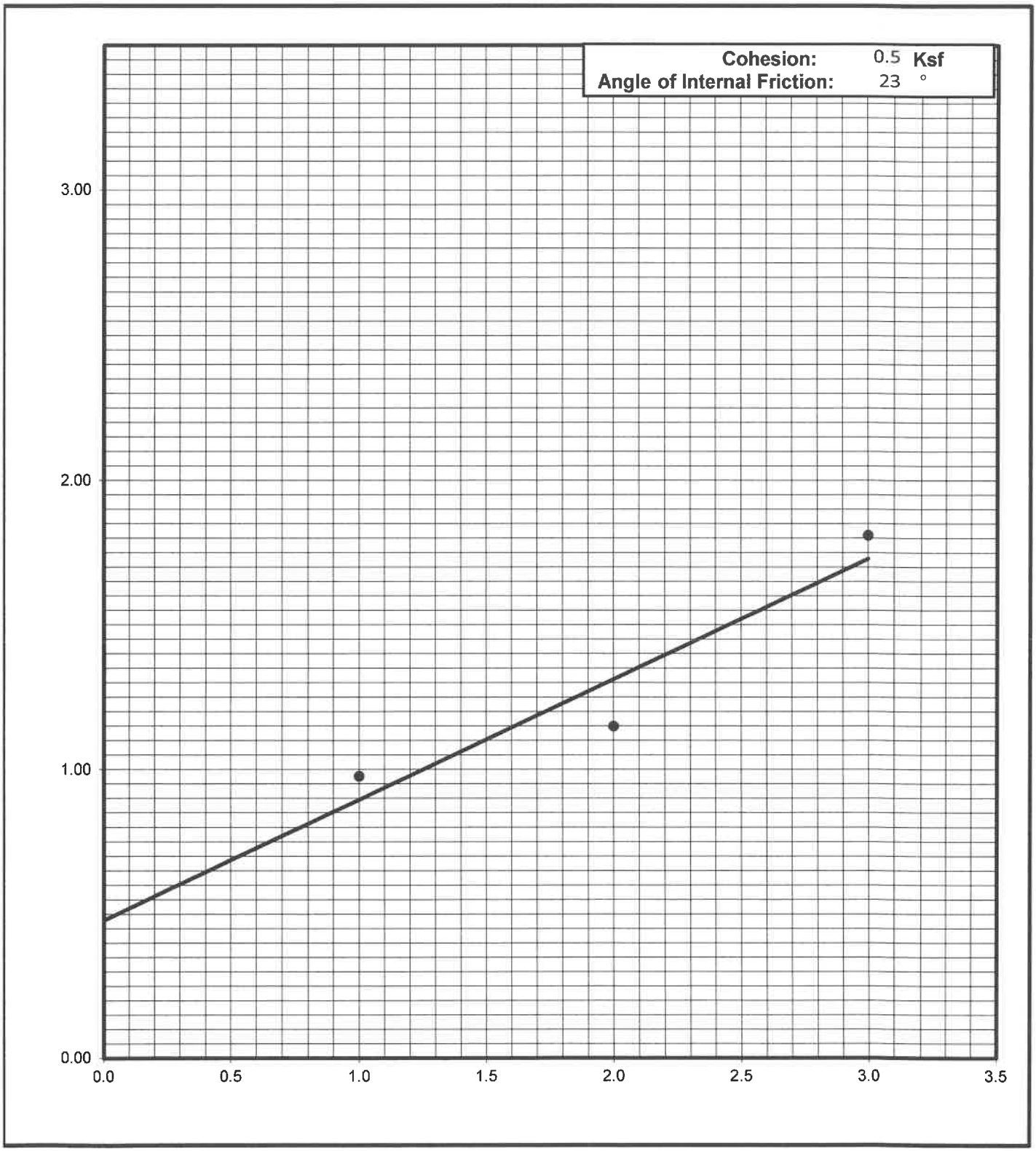
Project No	Boring No. & Depth	Date	Soil Classification
012-24185	B2 @ 2-3'	11/6/2024	CL



Krazan Testing Laboratory

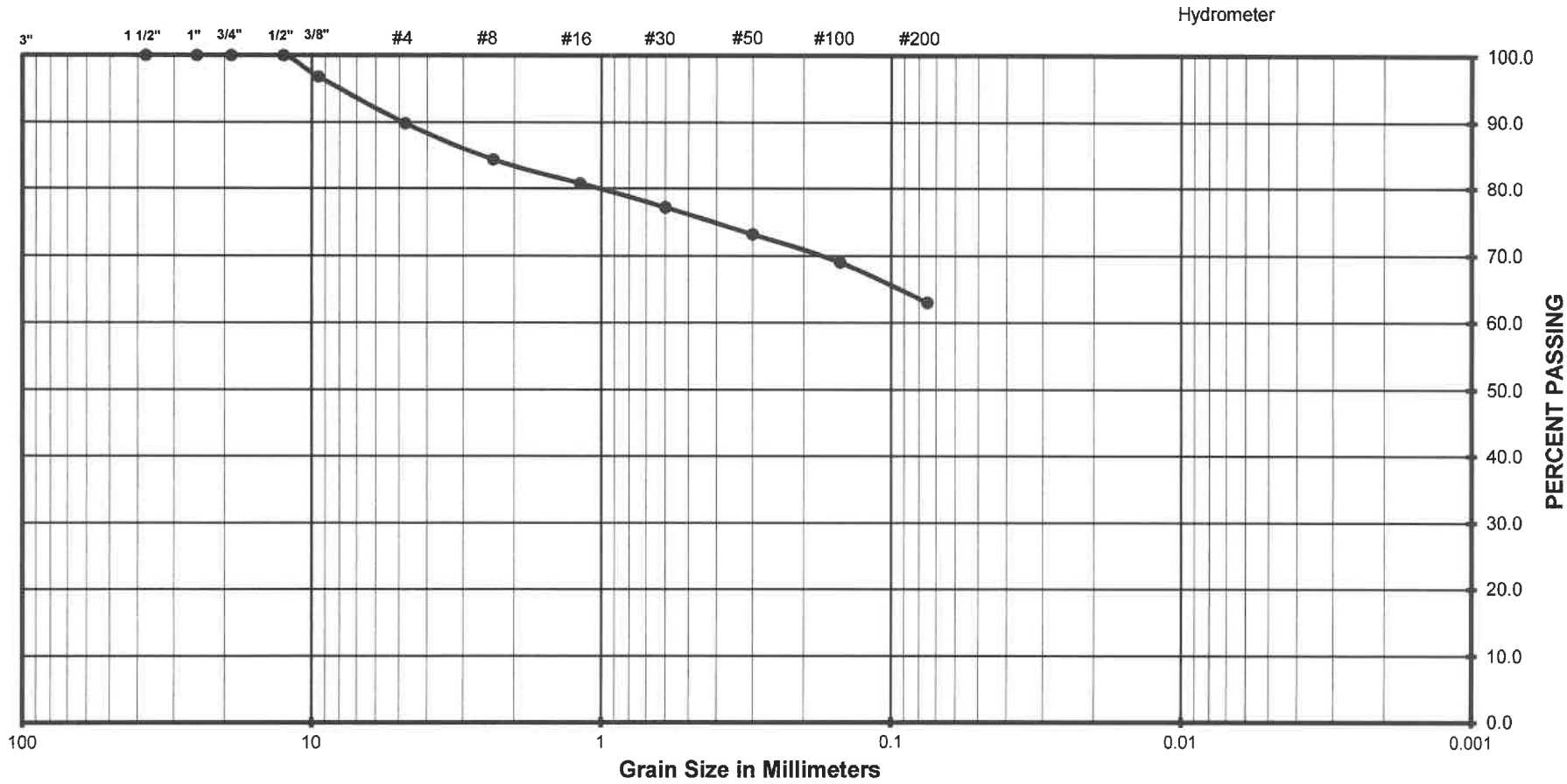
Shear Strength Diagram (Direct Shear)
ASTM D - 3080 / AASHTO T - 236

Project Number	Boring No. & Depth	Soil Type	Date
012-24185	B3 @ 2-3'	CL	11/6/2024



Krazan Testing Laboratory

Grain Size Analysis



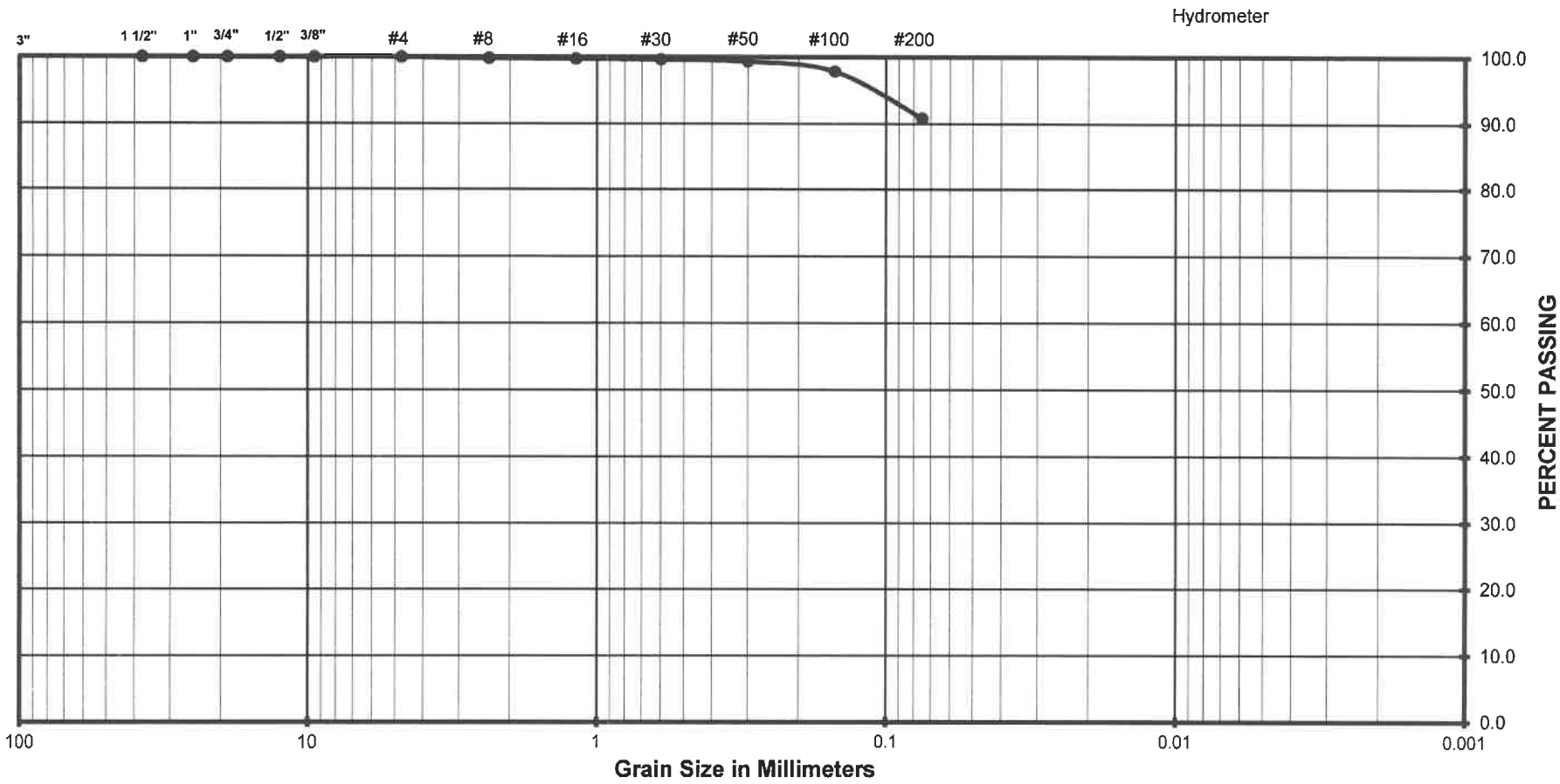
Gravel		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

(Unified Soils Classification)

Project Name	New Programming Building
Project Number	012-24185
Soil Classification	CL w/ grvl
Sample Number	B1 @ 2-3'

Krazan Testing Laboratory

Grain Size Analysis



(Unified Soils Classification)

Project Name	New Programming Building
Project Number	012-24185
Soil Classification	CL
Sample Number	B2 @ 2-3'

Krazan Testing Laboratory

Expansion Index Test

ASTM D - 4829

Project Number	: 012-24185
Project Name	: New Programming Building
Date	: 11/6/2024
Sample location/ Depth	: B1 @ 1-2'
Sample Number	: X1
Soil Classification	: CL

Trial #	**1**	**2**	**3**
Weight of Soil & Mold, gms	760.8		
Weight of Mold, gms	368.9		
Weight of Soil, gms	391.9		
Wet Density, Lbs/cu.ft.	118.2		
Weight of Moisture Sample (Wet), gms	200.0		
Weight of Moisture Sample (Dry), gms	180.4		
Moisture Content, %	10.9		
Dry Density, Lbs/cu.ft.	106.6		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	50.5		

Time	Inital	30 min	1 hr	6hrs	12 hrs	24 hrs
Dial Reading	0	--	--	--	--	0.0771

Expansion Index $_{measured}$ = 77.1

Expansion Index = **77**

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

Krazan Testing Laboratory

Plasticity Index of Soils

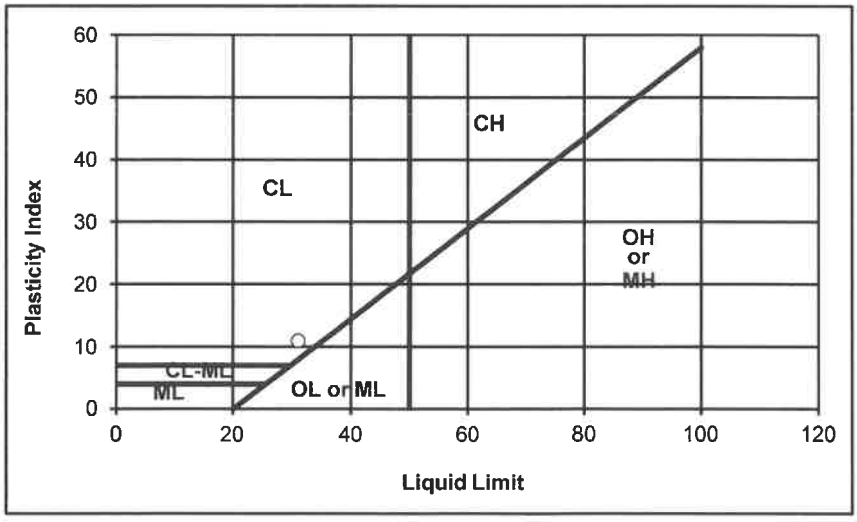
ASTM D4318/AASHTO T89 T90/CT 204

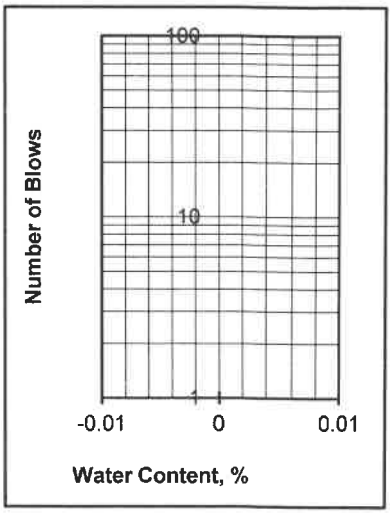
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 5-6'
Sample Description: CL

Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	46.01	45.37		44.98	46.56	
Weight of Dry Soil & Tare (g)	43.14	42.57		41.08	42.29	
Weight of Tare (g)	28.74	28.71		28.49	28.56	
Weight of water (g)	2.87	2.80		3.90	4.27	
Weight of Dry Soil (g)	14.40	13.86		12.59	13.73	
Water Content (% of dry wt.)	19.9%	20.2%		31.0%	31.1%	
Number of Blows				25	25	
	Plastic Limit : 20			**Liquid Limit : 31**		

Plasticity Index : 11
Unified Soil Classification : CL
Requirement:
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

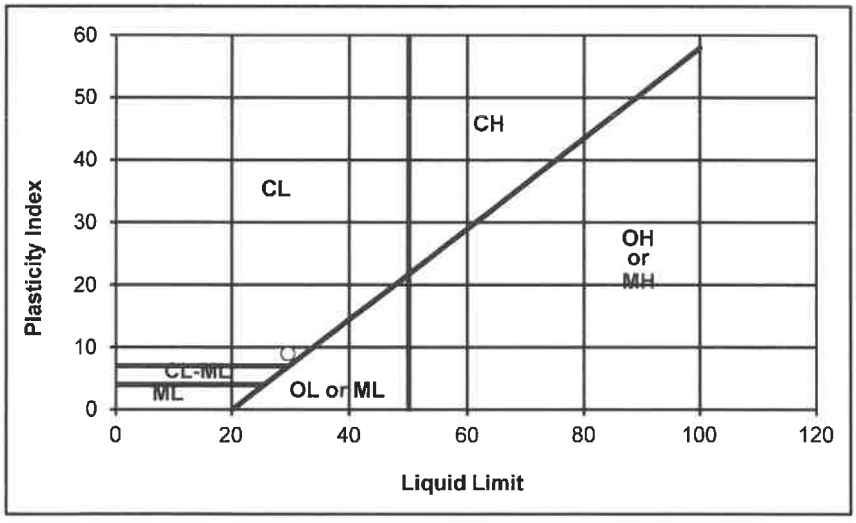
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 10-11'
Sample Description: CL

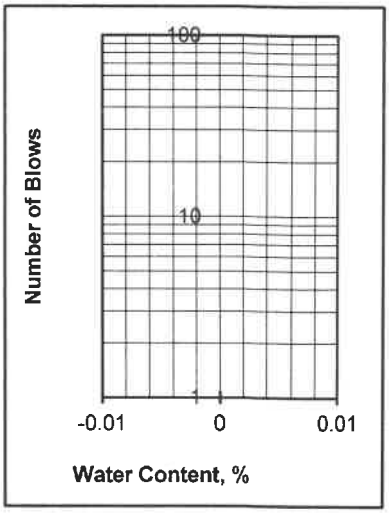
Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	40.40	43.54		51.34	56.87	
Weight of Dry Soil & Tare (g)	38.29	41.03		46.09	50.48	
Weight of Tare (g)	28.27	28.61		28.56	28.50	
Weight of water (g)	2.11	2.51		5.25	6.39	
Weight of Dry Soil (g)	10.02	12.42		17.53	21.98	
Water Content (% of dry wt.)	21.1%	20.2%		29.9%	29.1%	
Number of Blows				25	25	

Plastic Limit : 21 **Liquid Limit : 30**

Plasticity Index : 9
Unified Soil Classification : CL **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

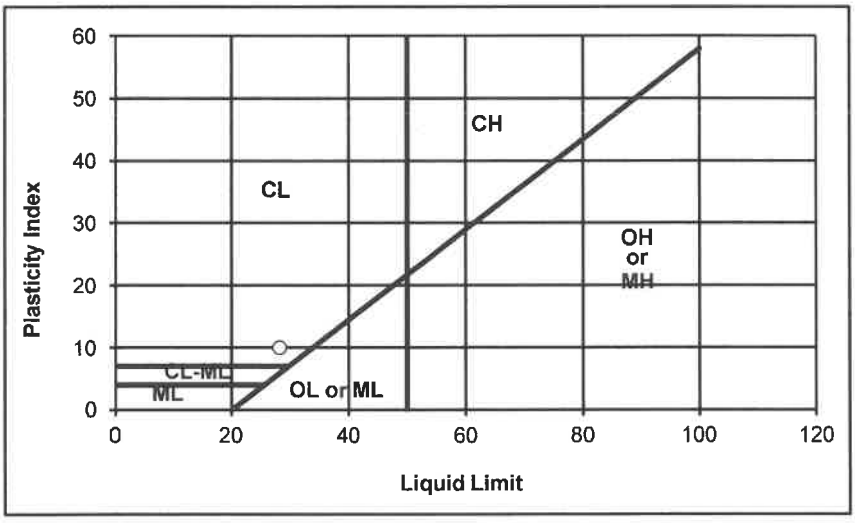
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 15-16'
Sample Description: CL

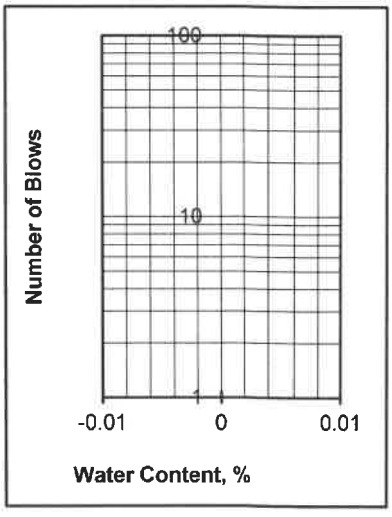
Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	47.51	46.84		55.51	51.75	
Weight of Dry Soil & Tare (g)	44.62	44.02		49.60	46.63	
Weight of Tare (g)	28.74	28.30		28.49	28.55	
Weight of water (g)	2.89	2.82		5.91	5.12	
Weight of Dry Soil (g)	15.88	15.72		21.11	18.08	
Water Content (% of dry wt.)	18.2%	17.9%		28.0%	28.3%	
Number of Blows				25	25	

Plastic Limit : 18 **Liquid Limit : 28**

Plasticity Index : 10
Unified Soil Classification : CL **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

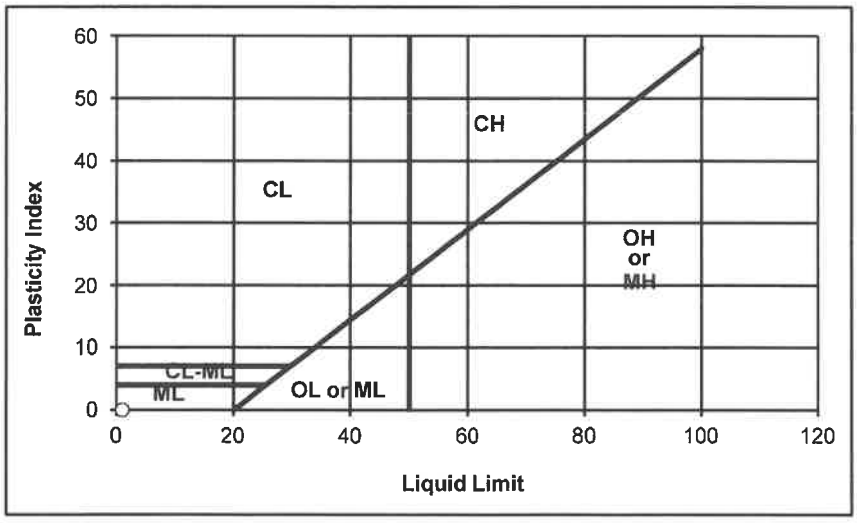
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 20-21'
Sample Description: SM/ML

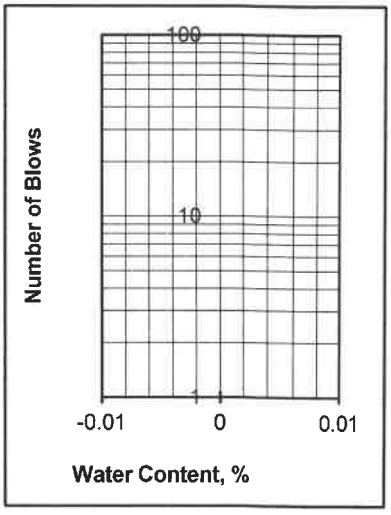
Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

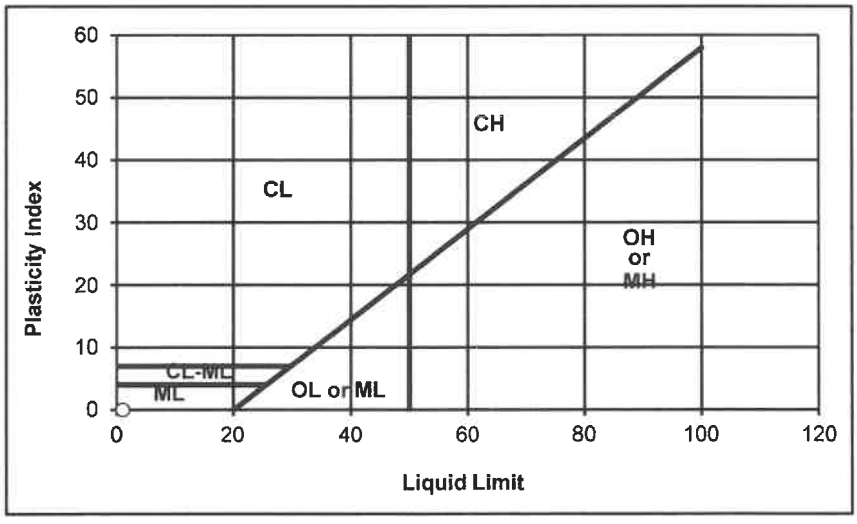
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 25-26'
Sample Description: SM

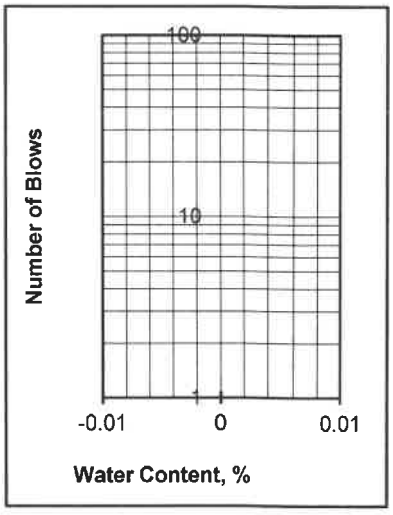
Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

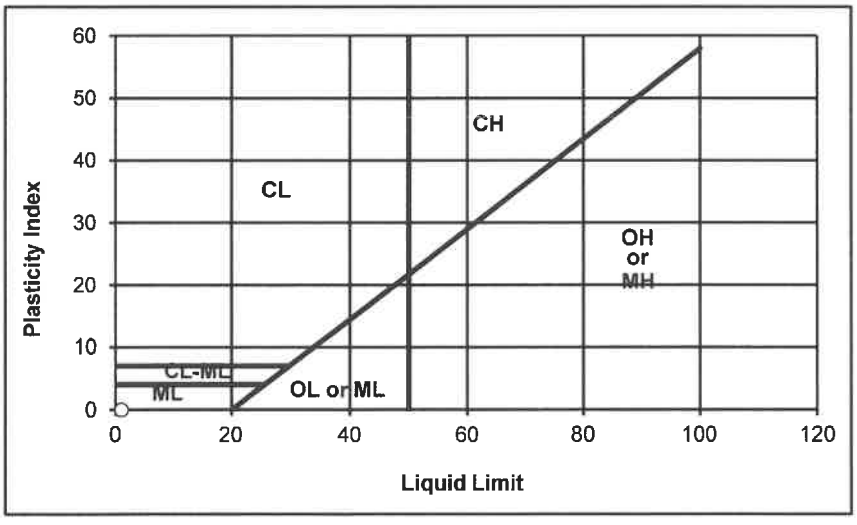
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 30-31'
Sample Description: SM

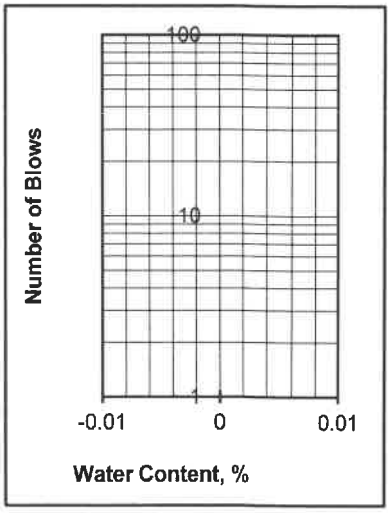
Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)						
Weight of Dry Soil & Tare (g)						
Weight of Tare (g)						
Weight of water (g)						
Weight of Dry Soil (g)						
Water Content (% of dry wt.)						
Number of Blows						

Plastic Limit : N/D **Liquid Limit : N/D**

Plasticity Index : NON-PLASTIC
Unified Soil Classification : NON-PLASTIC **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

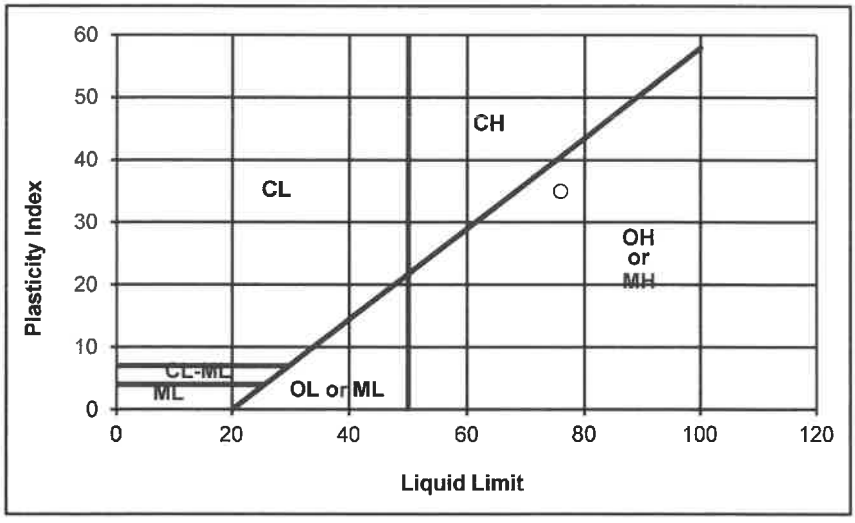
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 35-36'
Sample Description: MH

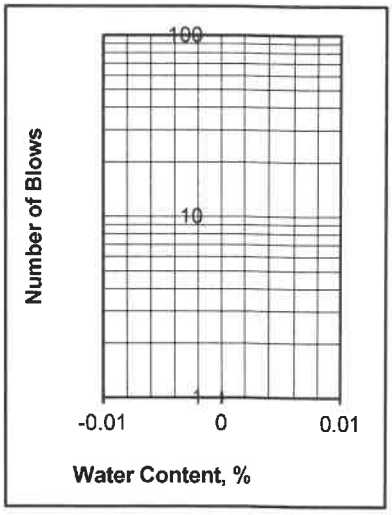
Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	38.73	42.19		46.97	50.22	
Weight of Dry Soil & Tare (g)	35.64	38.17		38.97	40.90	
Weight of Tare (g)	28.13	28.48		28.53	28.53	
Weight of water (g)	3.09	4.02		8.00	9.32	
Weight of Dry Soil (g)	7.51	9.69		10.44	12.37	
Water Content (% of dry wt.)	41.1%	41.5%		76.6%	75.3%	
Number of Blows				25	25	

Plastic Limit : 41 **Liquid Limit : 76**

Plasticity Index : 35
Unified Soil Classification : MH or OH **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

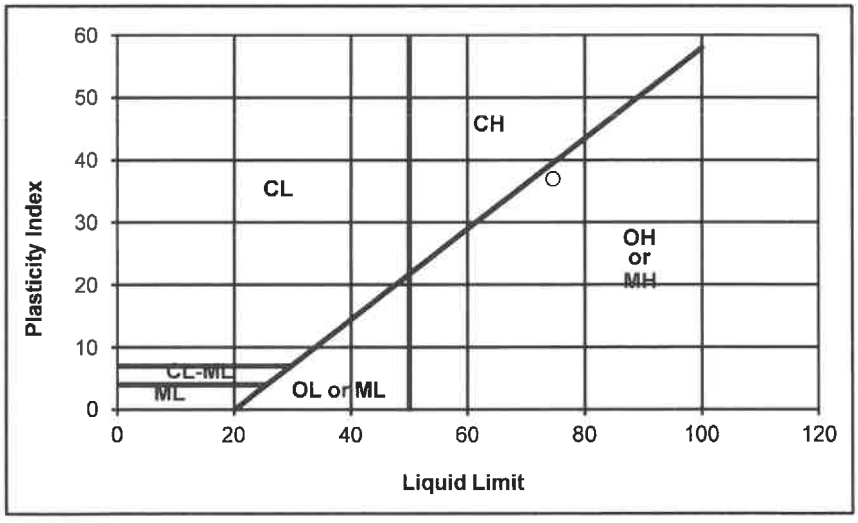
ASTM D4318/AASHTO T89 T90/CT 204

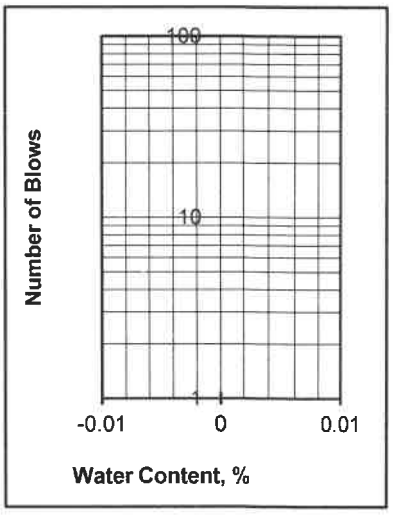
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 40-41'
Sample Description: MH

Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	41.22	41.63		43.89	42.89	
Weight of Dry Soil & Tare (g)	37.74	38.06		37.25	36.77	
Weight of Tare (g)	28.74	28.70		28.42	28.50	
Weight of water (g)	3.48	3.57		6.64	6.12	
Weight of Dry Soil (g)	9.00	9.36		8.83	8.27	
Water Content (% of dry wt.)	38.7%	38.1%		75.2%	74.0%	
Number of Blows				25	25	
	Plastic Limit : 38			**Liquid Limit : 75**		

Plasticity Index : 37
Unified Soil Classification : MH or OH **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

Unusual Conditions, Other Notes:

Plasticity Index of Soils

ASTM D4318/AASHTO T89 T90/CT 204

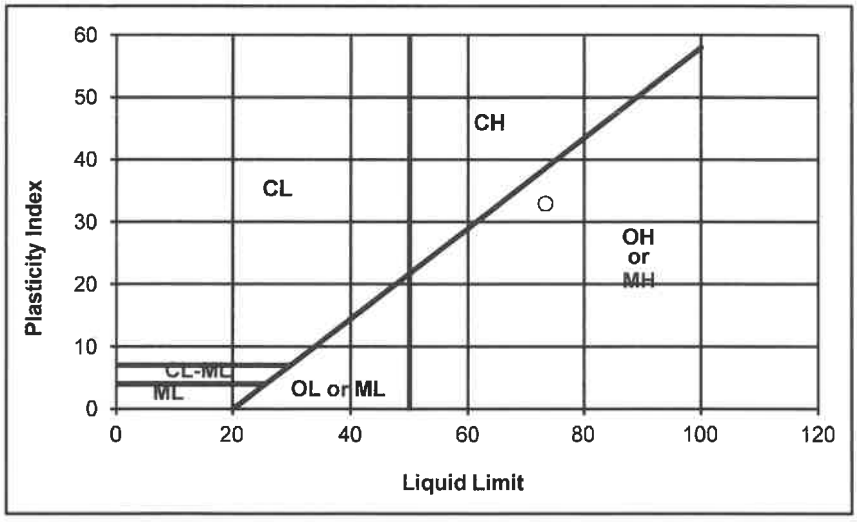
Project: **New Programming Building**
Project Number: **012-24185**
Date Sampled: 10/25/2024
Sampled By: DA
Sample Number: -
Sample Location: B1 @ 45-46'
Sample Description: MH

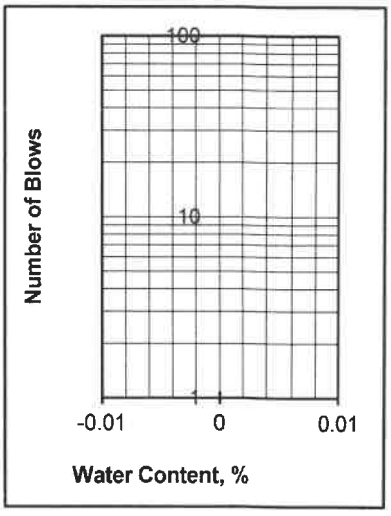
Date Tested: 10/30/2024
Tested By: JM
Verified By: JG

	Plastic Limit			Liquid Limit		
Trial Number	1	2	3	1	2	3
Weight of Wet Soil & Tare (g)	39.13	39.47		40.67	45.69	
Weight of Dry Soil & Tare (g)	36.00	36.27		35.54	38.40	
Weight of Tare (g)	28.32	28.27		28.54	28.48	
Weight of water (g)	3.14	3.20		5.13	7.29	
Weight of Dry Soil (g)	7.68	8.00		7.00	9.92	
Water Content (% of dry wt.)	40.8%	40.0%		73.3%	73.5%	
Number of Blows				25	25	

Plastic Limit : 40 **Liquid Limit : 73**

Plasticity Index : 33
Unified Soil Classification : MH or OH **Requirement:**
Approx. % of Material Retained on # 40 Sieve:





Departures from Outlined Procedure:

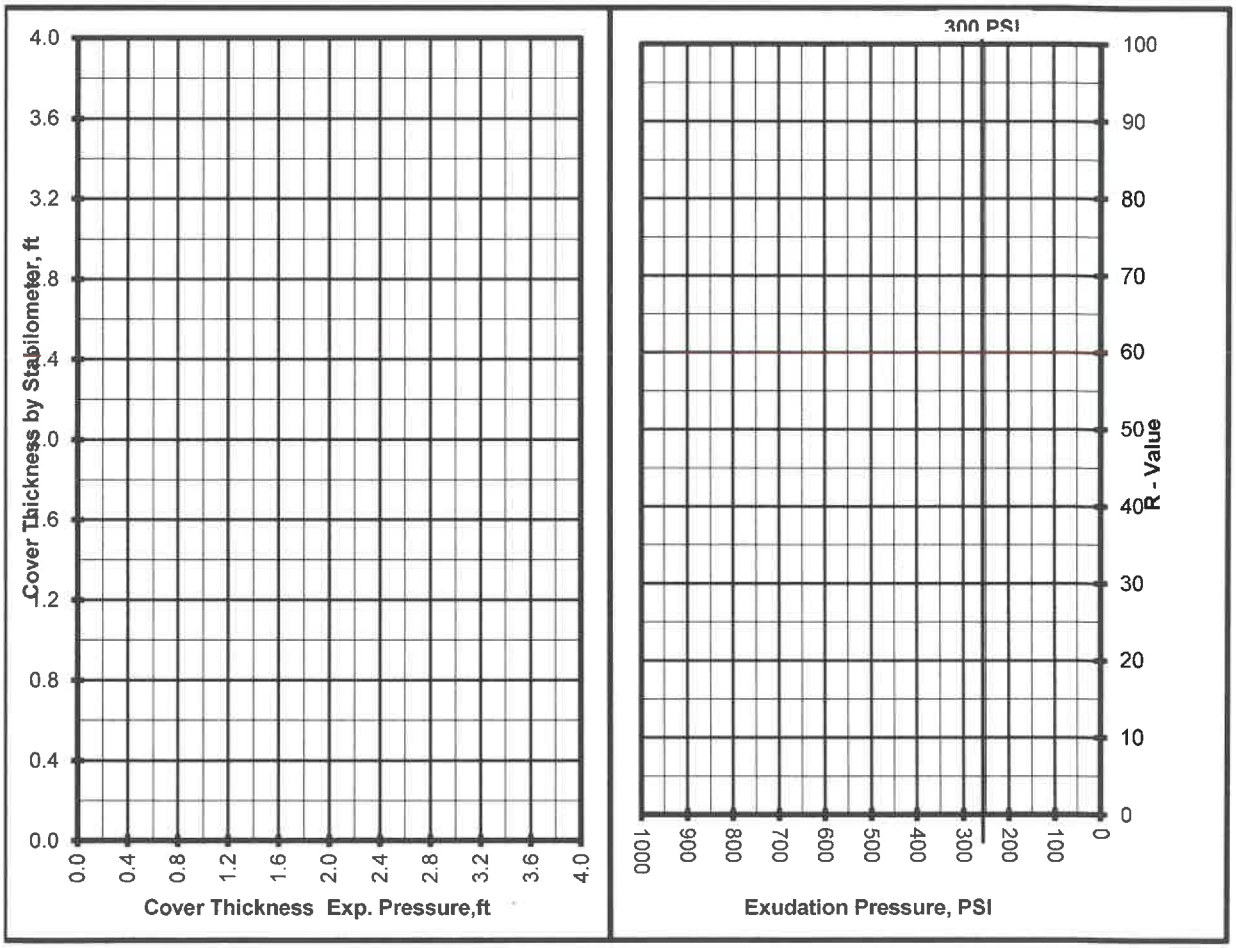
Unusual Conditions, Other Notes:

R - VALUE TEST
ASTM D - 2844 / CAL 301

Project Number	:	012-24185
Project Name	:	New Programming Building
Date	:	10/30/2024
Sample Location/Curve Number	:	RV#1
Soil Classification	:	CL

TEST	A	B	C
Percent Moisture @ Compaction, %			
Dry Density, lbm/cu.ft.	R - Value less than 5 Sample Exuded from bottom of Mold During test		
Exudation Pressure, psi			
Expansion Pressure, (Dial Reading)			
Expansion Pressure, psf			
Resistance Value R			

R - Value at 300 PSI Exudation Pressure	**< 5**
R - Value by Expansion Pressure	



APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including but not limited to the furnishing of all labor, tools, and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans, and disposal of excess materials.

PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of Krazan and Associates, Inc., hereinafter known as the Soils Engineer and/or Testing Agency. Attainment of design grades when achieved shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer or project Architect.

No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

TECHNICAL REQUIREMENTS: All compacted materials shall be densified to a density not less than 90 percent relative compaction based on ASTM Test Method D1557 or CAL-216, as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be as determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the soil report.

The Contractor shall make his own interpretation of the data contained in said report, and the Contractor shall not be relieved of liability under the Contract documents for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or windblown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grubbing and the preparations of foundation materials for receiving fill.

CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter, and all other matter determined by the Soils Engineer to be deleterious or otherwise unsuitable. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots larger than 1 inch. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations should not be permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

SUBGRADE PREPARATION: Surfaces to receive Engineered Fill, building or slab loads shall be prepared as outlined above, excavated/scarified to a depth of 12 inches, moisture-conditioned as necessary, and compacted to 90 percent relative compaction.

Loose soil areas, areas of uncertified fill, and/or areas of disturbed soils shall be moisture-conditioned as necessary and recompacted to 90 percent relative compaction. All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any of the fill material.

EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. However, compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer.

Both cut and fill areas shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill are as specified.

APPENDIX C

PAVEMENT SPECIFICATIONS

1. DEFINITIONS - The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

The term "Standard Specifications": hereinafter referred to is the 2018 Standard Specifications of the State of California, Department of Transportation, and the "Materials Manual" is the Materials Manual of Testing and Control Procedures, State of California, Department of Public Works, Division of Highways. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as defined in the applicable tests outlined in the Materials Manual.

2. SCOPE OF WORK - This portion of the work shall include all labor, materials, tools, and equipment necessary for, and reasonably incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically noted as "Work Not Included."

3. PREPARATION OF THE SUBGRADE - The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 90 percent. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

4. UNTREATED AGGREGATE BASE - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class 2 material, 1½ inches maximum size. The aggregate base material shall be spread and compacted in accordance with Section 26 of the Standard Specifications. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent.

5. AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class 2 material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent, and it shall be spread and compacted in accordance with Section 25 of the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

6. ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades and dimensions shown on the plans. The viscosity grade of the asphalt shall be PG 64-10. The mineral aggregate shall be Type B, ½ inch maximum size, medium grading and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The drying, proportioning and mixing of the materials shall conform to Section 39.

The prime coat, spreading and compacting equipment and spreading and compacting mixture shall conform to the applicable chapters of Section 39, with the exception that no surface course shall be placed when the atmospheric temperature is below 50° F. The surfacing shall be rolled with a combination of steel wheel and pneumatic rollers, as described in Section 39-6. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

7. FOG SEAL COAT - The fog seal (mixing type asphaltic emulsion) shall conform to and be applied in accordance with the requirements of Section 37.

Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

April 16, 2025 Project No. 034-25009

Mr. Bryan Behn
Merced City School District
2105 Wardrobe Avenue
Merced, California 95340
bbehn@mcsd.k12.ca.us

RE: Report of Findings
Phase II Limited Geophysical Survey
New Programming Building
2600 K Street
APN 030-022-008
Merced, California 95340

Dear Mr. Behn:

Pursuant to your request, Krazan & Associates, Inc. (Krazan) has conducted a Phase II Limited Geophysical Survey (LGS) to locate possible underground storage tanks (USTs) at the referenced property (subject site). The scope of work was based on the findings and recommendations provided in Krazan's January 20, 2025, *Phase I Environmental Site Assessment* (ESA) report for the referenced subject site prepared for the Merced City School District (MCSD; client). The work was conducted in conjunction with a property refinance and not at the request of a regulatory agency. Figure 1 (see Appendix A) is a vicinity map.

BACKGROUND

During the referenced Phase I ESA, Krazan identified no evidence of controlled recognized environmental conditions (CRECs) or historical recognized environmental conditions (HRECs) in connection with the subject site as defined by ASTM E 1527-21. However, the following recognized environmental conditions (RECs), potential areas of concern (PAOCs), ASTM non-scope issues, and housekeeping issues were identified in connection with the subject site:

RECs

- According to records on file with the State of California Water Resources Control Board, predecessor of the California Regional Water Quality Control Board (RWQCB), fuel underground storage tanks (USTs) are associated with the historical subject site address of 2604 K Street. The 2604 K Street address appears to be in occasional use for the on-site building and was observed on the side of the on-site building along with the 2600 K Street address at the time of Krazan's December 23, 2024, site reconnaissance. Records associated with a California Water Resources Control Board database printout dated June 1, 1988, indicate that one (1) diesel fuel UST of unknown capacity was installed in 1963, and one (1) unleaded gasoline UST of unknown capacity was installed on an unknown date at the 2604 K Street subject site address. The two (2) fuel USTs are reported to be of unknown construction type with underground suction piping and not equipped with leak detection. The MCSD is listed as the owner of the USTs, with the USTs located at the 2604 K Street MCSD Transportation Department facility.

At the time of Krazan site reconnaissance, an apparent steel vent pipe was observed on the northern wall of the on-site building near the northwestern corner of the building. The apparent vent pipe protrudes from the ground surface, reaches up the building wall, and terminates as a covered pipe near the apex of the roof in a manner typical of fuel UST vents. Based on the above-referenced reported presence of two (2) fuel USTs associated with the subject site address, the apparent vent pipe may indicate that one (1) or both fuel USTs are located adjacent to the north of the western end of the on-site building. However, the vent pipe is immediately proximate to three apparent saw cuts in the asphalt pavement approximately 13 feet in width by 10 feet in length, suggesting that the pavement may have been patched in connection with a potential excavation beneath the area of patched pavement possibly associated with the removal of one or both fuel USTs. Additionally, four (4) apparent saw cuts in the asphalt pavement were observed five (5) to 10 feet northeast of the northeastern corner of the on-site building. These saw cuts form a rectangular potential pavement patch 12 feet in width by 11 feet in length, suggestive of a second potential excavation beneath the area of patched pavement possibly associated with the removal of an underground storage tank(s).

No record of the installation, operation, or removal of fuel USTs is on file with the Merced County Environmental Health Division (MCEHD) for the subject site, the lead regulatory agency for USTs and hazardous materials handling facilities located in Merced County. Additionally, Mr. Bryan Behn, Director of Facilities for the MCSD, the owner and occupant of subject site for the past 70+ years, stated that none of the MCSD staff he spoke with, some of which were familiar with the subject site for 30+ years, were aware of the presence of USTs on the subject site. Therefore, no records pertaining to the installation, operation, or removal of the USTs reportedly located at the subject site were identified during this assessment. Consequently, although some circumstantial evidence in the form of saw cuts in the asphalt was observed proximate to an apparent UST vent pipe, there is no documentation substantiating that that the diesel fuel and/or the gasoline USTs have been removed from the subject site. Furthermore, assuming that the USTs have been removed from the subject site, there is no record of standard UST closure activities such as a subsurface investigation to document the condition of the subsurface environment proximate to the USTs at removal. Given the time frame in which the USTs appear to have been installed (1963 and perhaps earlier), and the above-referenced information contained in the State Water Resources Control Board database, it is possible that single-walled steel tanks and steel product distribution lines without corrosion protection were located on the subject site and the condition/structural integrity of the tanks and product distribution lines during the time of operation are unknown. Based on the above-referenced considerations, the potential exists for an unauthorized release(s) of diesel fuel and/or gasoline to have occurred because of the historical operation of the fuel USTs and fuel dispensers on site for an extended period circa 1963, and the current condition of the subsurface of the subject site proximate to these fuel USTs is unknown.

Krazan recommended that a LGS be conducted to assess the presence or absence of subsurface metallic anomalies characteristic of USTs and/or subsurface native ground disturbances characteristic of the location of former USTs. Irrespective of the outcome of the Geophysical Survey, Krazan recommended that a Limited Subsurface Assessment (LSA) be conducted at the location of the two (2) above-referenced areas of apparent saw cuts in the asphalt pavement and at any additional areas at which the Geophysical Survey indicates that USTs are or may have been present.

PAOCs

- The former City of Merced Fire Station #3 facility was previously located across a paved alley 20 feet north of the subject site at 364 27th Street/364 West 27th Street. According to records on file with the RWQCB, two (2) 380-gallon gasoline USTs installed in 1951 and last used in 1980 were located at the 364 27th Street/364 West 27th Street Fire Station property. The two (2) fuel USTs are

reported to have been of unknown construction type with underground suction piping and not equipped with leak detection. Furthermore, the RWQCB GeoTracker database indicates that the 364 27th Street/364 West 27th Street address is a leaking UST site at which: 1) the leak was discovered in late-1987; 2) the release was gasoline; 3) soil was the impacted medium; and 4) case closure status was granted by the oversight regulatory agencies on July 10, 1990. No reports or other documents related to the gasoline release, the investigation of the gasoline release, or the closure of this LUST site are contained in the GeoTracker database, although Merced County is listed as the lead oversight agency for the 364 27th Street/364 West 27th Street LUST site. However, according to a representative of the MCEHD, no records are on file with the MCEHD for the 364 27th Street/364 West 27th Street LUST site, and a representative of the Central Valley RWQCB stated that no hardcopy or digital records are on file with the RWQCB for the 364 27th Street/364 West 27th Street LUST site. Consequently, the location of the former gasoline USTs, and thus the location of the gasoline release, relative to the subject, the amount of the gasoline released into the environment, and the lateral and vertical extents of the subsurface impact are unknown, significantly complicating evaluation of the potential that this gasoline release impacted the subsurface of the subject site. Groundwater in the vicinity of the subject site is currently projected to be first encountered at a depth of approximately 100 feet below ground surface (bgs) and to flow toward the southwest. Given that this release is characterized as a soil only impact in the GeoTracker database, it appears that groundwater was relatively deep at the time of the gasoline release, although significantly shallower than it is currently (groundwater has since been drawn down substantially via long term agricultural use). Based on these considerations, the potential that contaminated groundwater currently represents a significant exposure mechanism on the subject site appears to be low. However, based on the release unknowns addressed previously, the volatility of some gasoline constituents of potential concern (COPCs), and the well-established tendency for omni-directional subsurface migration of volatile gasoline COPC vapors along subsurface preferential pathways such as utility trenches, the potential exists for volatile COPCs to have migrated beneath the subject site. While the potential exists that natural processes may have reduced the concentration of volatile COPCs in the subsurface environment to concentrations below current regulatory action levels over the course of the past 30+ years, without data generated from the analysis of recently collected subsurface samples it is not possible to substantiate that hypothesis. Therefore, the condition of soil vapor beneath the northern portion of the subject site is unknown relative to potential impact from gasoline derived volatile COPCs associated with the northern adjacent LUST site.

Krazan recommended that the LSA recommended previously be expanded to assess the presence or absence of significant concentrations of volatile COPCs in soil vapor in the northern portion of the subject site associated with the northern adjacent LUST site. If significant concentrations of volatile COPCs are identified in soil vapor, additional subsurface investigation may be warranted.

- Krazan's historical research and information obtained from Mr. Behn indicate that the on-site building has been present since at least 1957 and indicate that the building was utilized historically by the MCSD for school bus storage and vehicle/bus maintenance operations. A Sanborn Fire Insurance Map of the subject site dated 1962 depicts the existing on-site building with a "School Bus Garage" label. At the time of Krazan's site reconnaissance, the on-site building contained one restroom with a sink and toilet, which according to Mr. Behn is the location of the restroom at original construction of the building. The restroom within the on-site building is currently connected to the City of Merced municipal sewer system. However, according to an encroachment permit and a statement provided by the City of Merced, "it seems sewer service was started in this location in 1982," suggesting that the building restroom was connected to an on-site septic system prior to 1982. However, building permits provided by the City of Merced for the subject site contained no permits for the installation or removal of a septic system/tank. Therefore, based on the information provided by the City of Merced, a septic system/tank may be present beneath the subject site.

At the time of Krazan's site reconnaissance, housekeeping conditions were observed to be good within the on-site restroom, and no evidence of the unauthorized disposal of hazardous materials or hazardous waste was observed in association with the sink or toilet. However, the building has been present since at least 1957 and was utilized as a "bus garage" and vehicle maintenance shop historically. Although the efficacy of historical maintenance shop operations is unknown, Krazan's experience suggests that the disposal of hazardous materials/wastes via toilet and sink plumbing fixtures was not uncommon in the 1950s- to 1970s-time period, and restroom plumbing fixtures are located immediately proximate to former maintenance shop work areas. Consequently, given the likely presence of bus/vehicle maintenance operations during this time period, the use of hazardous materials associated with bus/vehicle maintenance operations, and the apparent use of a septic system on site, the potential exists for waste materials to have been disposed within the toilet and sink drains thereby entering the septic system and impacting the subsurface of the subject site. Therefore, although: 1) no material evidence was found during the course of this assessment of the unauthorized disposal of hazardous substances or hazardous waste into a potential on-site septic system; 2) natural processes would be expected to have degraded some types of simple hydrocarbon contaminants; and 3) Krazan's experience with sampling and analysis of soils from properties with similar septic system use scenarios suggests that the potential for a significant subsurface impact is low; given the potential for the use and disposal of chlorinated solvents during the 1950s- to 1970s-time period and the environmental persistence of chlorinated solvents, the condition of the subsurface of the subject site in the vicinity of a potential on-site septic system connected to the subject site building is unknown.

Given the proposed redevelopment of the subject site for school use, Krazan recommended that the focus of the LGS recommended previously be expanded to include an assessment of the presence or absence of subsurface anomalies characteristic of a septic tank. If an anomaly characteristic of a septic tank is identified, Krazan recommended that Phase II LSA be expanded to assess the presence or absence of significant concentrations of the COPCs related to historical shop operations. Additionally, following the conclusion of the subsurface assessment, the septic system should be properly abandoned or removed in accordance with State and local guidelines.

- At the time of Krazan's site reconnaissance, an area of pitted asphalt pavement approximately three feet in length by two feet in width was observed adjacent to the north of the on-site building near the northeastern corner of the building. The pitting appeared to be limited to an inch in depth, did not appear to penetrate the pavement to the underlying soil based upon visual observation, and did not extend laterally to the shallow stormwater gutter 10 feet distant. This pitting may have resulted from exposure to battery acid and/or other corrosive materials over an extended period; however, the actual cause of the pitting is unknown. Furthermore, the actual depth to which the pitting has occurred and/or cracks associated with the pitting has occurred is unknown, and thus the actual presence or absence of an impact to underlying soil is unknown.

  Krazan recommended that the LSA recommended previously be expanded to assess the presence or absence of significant concentrations of COPCs in soil beneath the pitted asphalt pavement.

- At the time of Krazan's site reconnaissance, a stormwater drain inlet was observed in the southwestern portion of the subject site at the termination of a shallow concrete stormwater drainage gutter (valley gutter). Krazan's review of historical aerial photographs indicates that the valley gutter has been located on site for 25+ years. Several areas of surface staining were noted within the concrete valley gutter and within the surrounding paved driveways/parking areas. No significant surface staining was noted within the valley gutter or adjacent to the drain inlet, nor were any odors or other obvious evidence of the intentional disposal of hazardous materials noted in association with the stormwater drain inlet. However, given the 25+ year age of the on-site stormwater drain system, the potential exists that fuel, coolant, and lubricant leakage from school bus/vehicle engines, along with potentially spilled hazardous materials within the on-site parking lot and/or intentionally disposed hazardous materials, have entered the on-site stormwater drain

and impacted the subsurface of the subject site via faulty subsurface piping and/or piping connections associated with the 25+ year old stormwater drain inlet. Although no material evidence was found during the course of this assessment of the unauthorized disposal of hazardous materials or hazardous wastes into the on-site stormwater drain, and Krazan's experience with sampling and analysis of soils from properties with similar stormwater drain/dry well use scenarios suggests that the potential for a significant subsurface impact is low, given the potential chronic leakage of engine fluids from buses/vehicles over a 25+ year period of time and the proximate use of hazardous materials associated with bus/vehicle maintenance over an extended period of time, coupled with the age of the subsurface piping and plumbing connections, the condition of the subsurface of the subject site proximate to the on-site stormwater drain inlet is unknown.

Given the proposed redevelopment of the subject site for school use, Krazan recommended that the LSA recommended previously be expanded to assess the presence or absence of significant concentrations of COPCs in soil proximate to the stormwater drain inlet located in the southwestern portion of the subject site.

March 5, 2025 Client Email

In an email dated March 5, 2025, the client requested that Krazan prepare a proposal to conduct a LGS only and not to include a Phase II scope of work that would fully address the RECs and PAOCs.

PURPOSE

Based on the client's March 5, 2025 request, the purpose of the Phase II LGA was to assess the presence or absence of a UST and other associated subsurface features. The client requested that the full scope of assessment proposed not be conducted at this time.

PHASE II SCOPE OF WORK

General Activities

An LGS was conducted using electromagnetic equipment in the vicinity of the inferred location of former on-site structures to assess the presence or absence of subsurface metallic anomalies characteristic of USTs and related features.

Following completion of the field investigation activities, Krazan prepared this report.

Investigation of Potential Presence of USTs

On March 25, 2025, an LGS was conducted by Subsurface Surveys & Associates, Inc. (SSAI) of Carlsbad, California. The LGS equipment included Electromagnetic Instruments (Geonic's EM-61 and Fischer TW-6 M-Scope), Ground Penetrating Radar (GPR), Sensors and Software Noggin, Line Locators (RadioDetection 8200 Series and Ridgid SR-60, and Magnetics (Schonstedt GA-52). A detailed description of the LGS equipment and their uses and capabilities is provided in SSAI's Report (see Appendix A).

The area of the LGS investigation was approximately 180 feet by 220 feet; the subject site was occupied by one (1) industrial building (Note: the interior of thew building was not investigated). The sidewalks and grassy landscaping were investigated, but the city-owned alley northeast of the subject site was not investigated during the LGS. Figure 4 in Appendix A shows the approximate area investigated by the LGS.

REPORT OF FINDINGS

Potential Presence of USTs on the Subject Site

The LGS equipment did not detect the presence of USTs on the subject site. However, two (2) backfilled excavations were identified, one (1) at the northwest corner of the building and the other at the southeast corner, as shown on Figure 4 (see Appendix A). The northwest excavation measured approximately 10 feet by 10 feet and the southeast excavation measured approximately nine (9) feet by 11 feet. Both excavations were apparently backfilled with clean sand to approximately four (4) feet below ground surface (bgs) . The sand was underlain by pea gravel; due to the presence of the pea gravel, the bottom of the excavation could not be determined.

The LGS also identified the presence of "junk pipes" associated with the excavations. Besides the presence of various active and inactive, and possibly abandoned utilities, no other anomalies of either metallic or non-metallic nature were detected during the LGS on the subject site.

CONCLUSIONS, OPINIONS AND RECOMMENDATIONS

Although no USTs were detected, the presence of the two (2) excavation confirms the likelihood that USTs were previously located on-site. As determined during the Phase I ESA, there is no documentation that soil samples were collected when the USTs and associated piping were removed. Thus, the presence of COPCs in subsurface soils in the areas of the excavations is unknown.

Krazan recommends that a Phase II LSA be conducted in the areas of the two (2) excavations to determine the presence of COPCs in soil.

LIMITATIONS

The findings of this report were based on the results of our field investigation and reported client excavation information, along with the interpretation of subsurface conditions associated with the LSS. Therefore, the data are accurate only to the degree implied by review of the data obtained and by professional interpretation.

This surface investigation of the subject site has been limited in scope. This type of assessment is undertaken with the calculated risk that the presence, full nature, and extent of contamination would not be revealed by methods employed. Therefore, no warranty is given; either expressed or implied that hazardous material contamination or buried structures, which would not have been disclosed through this investigation, do not exist at the subject site. Therefore, the data obtained are clear and accurate only to the degree implied by the sources and methods used. Matters related to reporting to regulators of subsurface conditions revealed by this investigation are the responsibility of the property owner and, if guidance is desired, legal counsel should be consulted.

The limited subsurface survey equipment is considered a state-of-the-art technology that is effective within certain limitations for the investigation of buried features such as septic tanks, fuel bunkers, USTs, and/or piping in areas accessible at the time of the investigation. In uncommon or atypical cases where bunkers or tanks are buried at depths greater than two (2) feet bgs and/or which may be covered by layers of pavement cumulatively in excess of two to four inches in thickness, rock, gravel or aggregate layers, dense (clayey) soils, or other surface or subsurface metallic objects (such as motor vehicles, fencing, piping, conduit or rebar) that can interfere with the electrical transmission/reception of the equipment, the equipment's technical capabilities can be exceeded to a degree where the presence of a UST or other metallic feature

could not be detected. No guarantee is made or implied that the geophysical survey will detect suspected metallic features under uncommon or atypical circumstances as described above, or that the discovery of underground piping or conduit commonly found underlying commercial properties in and of itself is evidence of the presence of USTs. The location of subsurface objects and utilities is dependent upon the recognition of physical phenomena at the ground surface. These phenomena can be magnetic fields or electromagnetic waves that give rise to a surface expression which in turn is interpreted as representative of subsurface objects. These waves, however, may be attenuated and/or distorted by several factors including soil moisture, corrosion, and proximity to other surface and subsurface facilities. The findings presented herewith are based on professional interpretation using state of the art methods and equipment and a degree of conservatism deemed proper as of this report date. It is not warranted that such data cannot be superseded by future geotechnical, environmental, or technical developments.

The findings presented herewith are based on professional interpretation using state of the art methods and equipment and a degree of conservatism deemed proper as of this report date. It is not warranted that such data cannot be superseded by future geotechnical, environmental, or technical developments. This assessment and report were authorized by and prepared for the exclusive use of our Client. Unauthorized use of or reliance on the information contained in this report without the expressed written consent of Krazan & Associates, Inc. is strictly prohibited.

CLOSING

We appreciate the opportunity to be of service to the Merced City School District. If you have any questions, or if we can be of further assistance, please feel free to contact me at (559) 348-2200.



Respectfully Submitted,
KRAZAN & ASSOCIATES, INC.

Michael H. Bowery, PG 5027
Senior Manager



Remington R. Alexander, PE 93713
Environmental Regional Manager

MHB/RRA/mlt

Attachments:

Appendix A Subsurface Survey & Associates, Inc. Report

SubSurface Surveys
& Associates, Inc.
An Applied Geophysical Company

2075 Corte Del Nogal, Suite W
Carlsbad, CA 92011

Office: (760) 476-0492
Fax: (760) 476-0493

April 10, 2025

Project/Invoice No. 25-126

Krazan and Associates
215 West Dakota Avenue
Clovis, California 93612

Attn: Michael Bowery

Re: Geophysical Investigation Report, Former Industrial Building, 2600 K St, Merced, California.

This report is to present the results of our geophysical survey carried out over all exterior portions of a former industrial building located at 2600 K Street in Merced, California (Figure 1). The survey was performed on March 25, 2025, and its primary purpose was to detect and delineate, insofar as possible, any underground storage tank (UST), backfilled excavations resulting from a UST removal, or any remaining UST-related piping or infrastructure. A secondary purpose of the survey was to detect and delineate, insofar as possible, all other utilities, conduits, pipelines, junk piping, buried debris, and any other anomalous, non-native buried object.

Electromagnetic induction (EM) with differentially-corrected integrated global positioning system (DGPS) and ground penetrating radar (GPR) were applied to the search as the primary tools. A second EM device was used for follow-up surveying and additional confirmation. Lastly, utility locators with line tracing capabilities were also used where applicable.

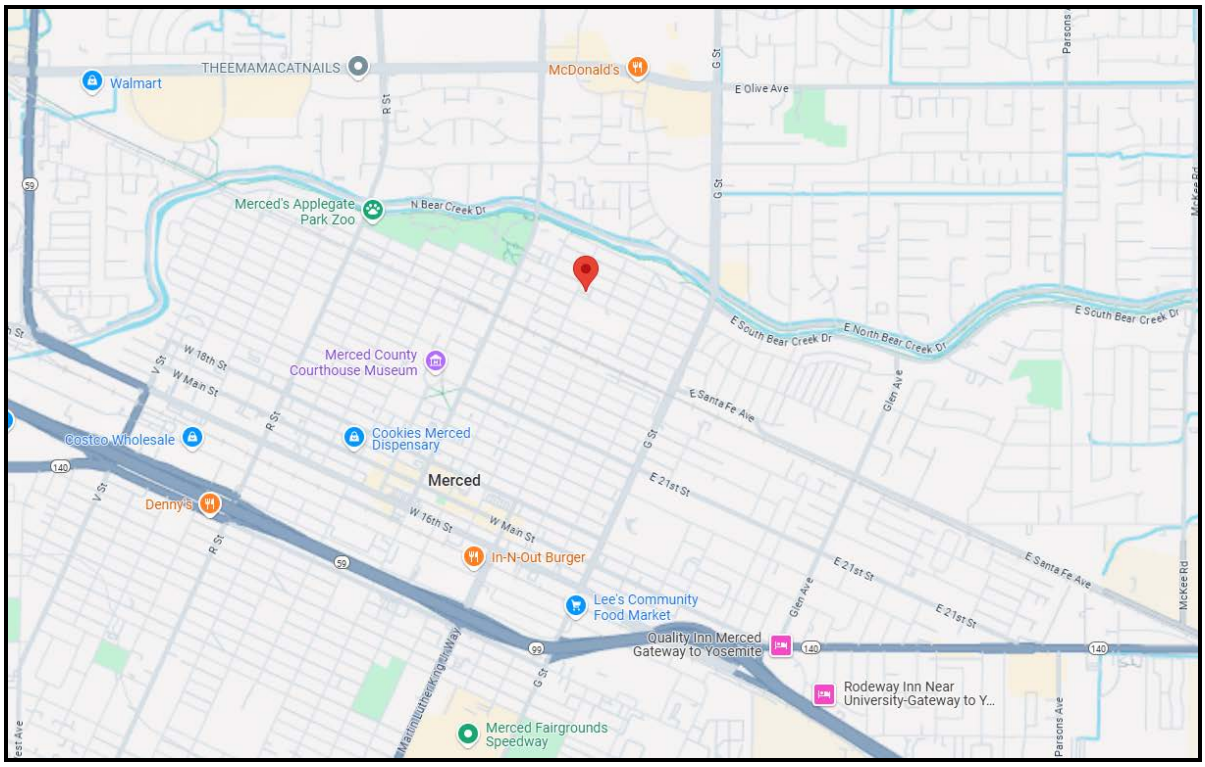


FIGURE 1. Site location map.

Site Description and Survey Design – The area of investigation was indicated in the field by the client's site representative and included a single parcel measuring 220 feet northwest-southeast and 180 feet northeast-southwest. The property possessed a single industrial-type building and note that the interior of this building was not investigated nor was it assessable. Lastly, the sidewalks and grassy landscaping southwest and northwest of the parcel were investigated but the city-owned alleyway northeast of the parcel was not.

Over the designated survey area all initial surveying was performed with a cart-mounted, dual-coil, time-domain EM device (Figure 2). Note that this instrument can take instantaneous readings and does not require its sensor to be stationary or preferentially oriented. This unit was configured to auto-record a reading every 0.5 seconds while simultaneously recording the sensor's global position in UTM meters, Zone 10. The instrument operator then continuously and methodically walked all portions of the designated survey area so as to ensure that a reading was taken at a maximum of five feet in any direction, with five feet being the nominal sensing width of the instrument. The data set was later downloaded and contoured into map format in order to determine where in the subsurface anomalous objects might be located.



FIGURE 2. Geonics EM61MK2



FIGURE 3. Sensors & Software GPR

Following the gridded surveying, additional investigations were performed by systematically free-traversing with the GPR (Figure 3) whereas it is simply monitored manually, continuously, and in real-time to determine which responses may be meaningful and due to significant targets of potential concern, and which were due to non-target or aboveground items and should be ignored (examples being false radar side reflections from the adjacent metal-walled building). Additional clarification and confirmation was achieved by similarly free-traversing with a second EM device as well, and note that, while free-traversing, no data is saved. This free-traversing, on-the-fly detection method, particularly for GPR, is extremely effective in areas where aboveground obstacles and obstructions may exist since the operator now does not need to traverse on an established grid but is instead free to orient, reorient, start, and stop profiles, as needed, in order to best avoid interferences while optimizing the units' detection capabilities since the anomalies themselves may be irregular in shape and orientation. During free-traversing, the radar unit's onboard automatic gains and real-time filters were perfectly adequate for imaging any potential anomaly, making post-processing of this data unnecessary.

In addition, the utility locators with line tracing capabilities were regularly used to impress signals onto pipes, generally through accessible risers and tracer wires when present, to delineate the lines' locations and orientations. The instruments were also used throughout the entire survey area in passive mode, configured to detect 60 Hz electrical signals and other common radio-frequency signals found in active electrical and

communication lines.

Gridded cart-mounted EM surveying was performed with a Geonics EM61MK2 with an external Trimble AgGPS 114 with OmniStar-provided differential GPS corrections (Figure 2). Radar free-traversing was performed with a Sensors & Software Noggin ground penetrating radar unit with a 250 MHz antenna mounted on a SmartCart (Figure 3), and follow-up EM free-traversing was performed with a Fisher TW-6 M-Scope. The utility locators with line tracing capabilities included a RadioDetection RD8200 and a RIDGID SR-60 SeekTech.

Brief Description of the Geophysical Methods Applied – The EM61MK2 instrument is a high resolution, time-domain device for detecting buried conductive objects. It consists of a powerful transmitter that generates a pulsed primary magnetic field when its coils are energized, which induces eddy currents in nearby conductive objects. The decay of the eddy currents, following the input pulse, is measured by the coils, which in turn serve as receiver coils. The decay rate for the two coils, mounted concentrically, one above the other is then measured as a voltage potential in milliVolts (mV). By making the measurements at a relatively long time interval (measured in microseconds) after termination of the primary pulse, the response is nearly independent of the electrical conductivity of the ground. Thus, the instrument is a super-sensitive metal detector. Due to its unique coil arrangement, the response curve is a single well-defined positive peak directly over a buried conductive object. This facilitates quick and accurate location of targets to depths of up to 12 feet depending on target size.

The GPR instrument beams energy into the ground from its transducer/antenna, in the form of electromagnetic waves. A portion of this energy is reflected back to the antenna at a boundary in the subsurface across which there is an electrical contrast. The instrument produces a continuous record of the reflected energy as the antenna is traversed across the ground surface. The greater the electrical contrast, the higher the amplitude of the returned energy. The radar wave travels at a velocity unique to the material properties of the ground being investigated, and when these velocities are known, the two-way travel times can be converted to depth. The depth of penetration and image resolution produced are a function of ground electrical conductivity and dielectric constant, and can vary widely and unpredictably from site to site.

The TW-6 M-Scope device energizes the ground by producing an alternating primary magnetic field with AC current in a transmitting coil. If conducting materials are within the area of influence of the primary field, AC eddy currents are induced to flow in the conductors. A receiving coil senses the secondary magnetic field produced by these eddy currents, and outputs the response as anomalous conditions. The strength of the secondary field is a function of the conductivity of the object, say a pipe, tank or cluster of drums, its size, and its depth and position relative to the instrument's two coils. Conductive objects, to a depth of approximately 7 feet for the M-Scope are sensed. The device is also somewhat focused; that is, it is more sensitive to conductors below the instrument than they are to conductors off to the side.

The line locator is used to passively detect energized high voltage electric lines and electrical conduit (60 Hz), RF signals (4-35 kHz), as well as to actively trace other utilities using a discrete signal. Where risers are present, the utility locator transmitter can be connected directly to the object, and a signal (256 Hz to 200 kHz) is sent traveling along the conductor, pipe, conduit, etc. In the absence of a riser, the transmitter can be used to impress an input signal on the utility by induction. In either case, the receiver unit is tuned to the input signal, and is used to actively trace the signal along the pipe’s surface projection.

Geophysical Survey Results and Conclusions – All instrument interpretation took place both in real time as the survey progressed, and was later refined and confirmed after careful review of all gridded EM61MK2 data after the survey concluded. Because of this, some minor information presented herein will differ slightly from that which was temporarily painted out in the field. These final results are presented with an accompanying site utility map with embedded EM61MK2 contour data (Figure 4), site photographs of notable findings (Figures 5-7), and a sample GPR image (Figure 8).

All detected items are indicated with coded colors using red for electric, light orange for telephone, light blue for active domestic water, dark blue for possible abandoned water, light yellow for active natural gas, dark yellow for possible abandoned natural gas, light green for wastewater drain, and dark green for sewer. Additionally, dark orange was used to mark the boundaries of two small, backfilled excavations and white was used to mark junk piping that appeared to be related to these two soil anomalies.

Near the north corner of the building a very overt and well-defined backfilled excavation was detected in the location shown in Figures 4 and 5 with a sample radar image provided in Figure 8. The uppermost 4 feet of the backfill appears to be mostly clean sand while the backfill below 4 feet appears to have a significant amount of gravel associated with it. Because of how radar interacts with this gravel, the absolute bottom of the former excavation could not be determined. This soil anomaly measured 10 x 10 feet in size and, aside from non-native backfill, no other foreign object was detected within this soil disturbance.

However, a junk pipe was detected in the immediate vicinity of the backfilled excavation, beginning at an old rusty pipe riser attached to the nearby building wall, then running towards the soil anomaly where it terminated abruptly at the anomaly's edge, as shown in Figure 5. While not visible in the accompanying photograph, the vertical pipe riser ran up the side of the building to its roof where it ended with a protective cap visually consistent with the type often associated with fuel or waste-oil USTs of 1940s or 1950s vintage.

A nearly identical backfilled excavation was detected near the east corner of the building, as shown in Figures 4 and 6. This soil anomaly measured approximately 9 x 11 feet and, on radar, appeared identical to the previous discussed backfilled excavation suggesting to us that both excavations were dug at the same time and backfilled in the exact same manner and using the same soil materials. A junk pipe was also detected here beginning at the anomaly's edge and running back towards the building, as shown in Figures 6 and 7. However, it could not be determined if this pipe terminated before reaching the building or if it continued into the building interior.

The building's domestic water and natural gas were readily detected in the locations shown in Figure 4 while main electric and telephone were overhead. The building's sewer was not positively detected, but may be in the location shown in Figure 4 based on some weak and somewhat inconsistent radar images. Note that the building interior was not accessible, and a visual inspection of the interior may have provided useful clues as to how and where sewer exited the structure.

South and southwest of the building several pipes were detected that appeared to us to be possible abandoned natural gas and abandoned domestic water, as shown in Figure 4. Ultimately both these pipes ran to the very south corner of the property where a concrete slab was located. We suggest that this concrete slab was a foundation for a former building structure or an overhead canopy, and, apparently, natural gas and water was routed to this structure in order to supply it.

Also shown in Figure 4 is the EM61MK2 contour data configured to best detect USTs or similar

underground metallic structures. Within the data set one can see various false anomalies due to metallic drain grates, the metal walls of the building, rebar-reinforcing with concrete sidewalks and swales, and two cars that were parked onsite while the data was being collected. Note that both cars eventually moved prior to the conclusion of the survey and both areas were later fully investigated by free-traversing with the GPR and secondary EM device. Additional free-traversing was also conducted with the GPR and other applicable instruments immediately adjacent to the building and over the various reinforced concrete to ensure that metallic anomalies also did not underly these areas.

Aside from the two aforementioned backfilled excavations and associated junk pipes, and the various active and possibly abandoned utilities, no other anomalies of either a metallic or non-metallic nature were detected anywhere on site. However, please note that a clarifier is located near the east corner of the building as shown in Figures 4, 6, and 7.

Please review again both accompanying graphics for the locations and orientations of all discussed anomalous objects detected on site, as well as the more mundane common utilities that were not discussed such as wastewater drain.

General Geophysical Limitations, Recommendations, and Further Cautions - It should be understood that nearly all work sites possess conditions or configurations limiting the effectiveness of both geophysical instruments and the surveying techniques in which they are deployed. Additionally, when such is not performing optimally it can often times occur unknowingly to the instrument operator. Consequently, the detection of buried objects in all circumstances **cannot be guaranteed**. Such geophysical limitations are numerous and difficult to predict beforehand, but may include such things as rebar-reinforced ground cover or aboveground metallic structures interfering with metal detection, abrupt changes in ground cover type disrupting radar signal, aboveground obstacles preventing full instrument traverses or restricting traverses to one direction only, nearby powerlines or EM transmitters interfering with instrument electronics, highly conductive background soil conditions limiting GPR penetration, non-metallic targets with geo-electrical properties similar to soil, nearby buried objects shielding true targets from detection, tracing signal jumping from the target pipe to nearby non-target conduits, and inaccessible risers, cleanouts, valve boxes, and manholes. If one or more geophysical instrument is rendered ineffective and cannot be utilized, the quality of the survey can be somewhat degraded.

For the above reasons, and in the interest of maximum safety, we encourage our clients to take advantage of Underground Service Alert (USA), Dig Alert, or other similar utility markout services. Furthermore, we recommend hand-auguring and the use of air knifing or vacuum extraction excavating methods that will limit damage to underground pipes, conduits, and utilities that were not detectable during the course of this survey. Please bear in mind that geophysical surveying is only one of several levels of protection that are available to our clients.

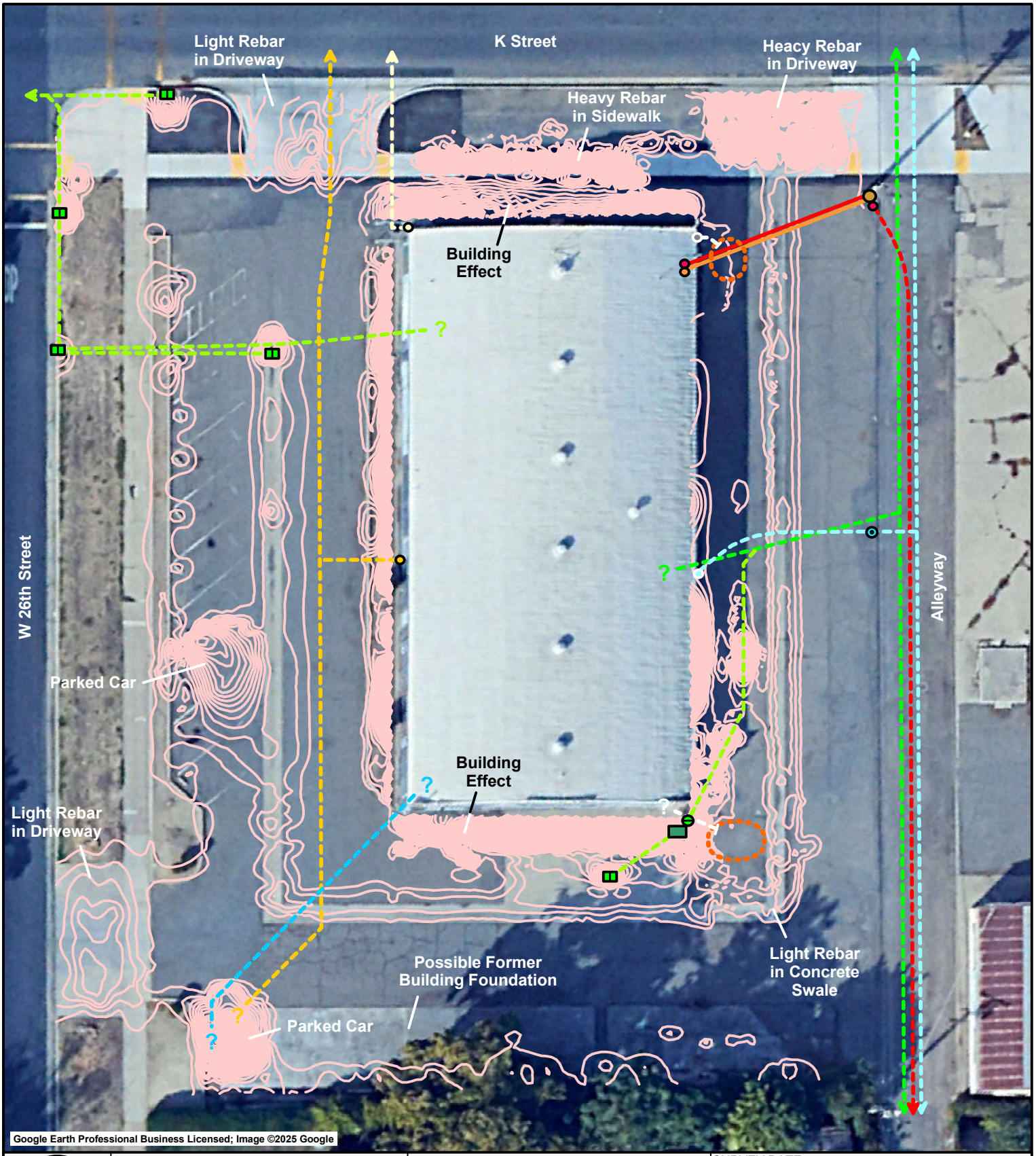
While the maps accompanying this report are an accurate representation of the site and our findings, they are not of precise engineering quality as they are not measured and mapped by a licensed land surveyor.

SubSurface Surveys and Associates makes no guarantee either expressed or implied regarding the accuracy of the findings and interpretations present. And, in no event will SubSurface Surveys and Associates be liable for any direct, indirect, special, incidental, or consequential damages resulting from interpretations and opinions presented herewith.

All data generated on this project are in confidential file in this office, and are available for review by authorized persons at any time. The opportunity to participate in this investigation is very much appreciated. Please call, if there are questions.



Travis Crosby
CA State Geophysics Registration GP1044
Senior Geophysicist, SubSurface Surveys



Sub Surface Surveys

SITE:
Former Industrial Building
2600 K Street
Merced, California

TITLE:
Site Anomaly Map w/ EM61MK2 Data

SURVEY DATE:
March 25, 2025

PREPARED FOR:
Krazan and Associates

SSS PROJECT NO:
25-126

LEGEND:

- Electric
- Electric Overhead
- Tele. Overhead
- Active Water
- Abandoned Water
- Active Natural Gas
- Aband. Natural Gas
- Sewer
- Wastewater Drain
- Electric Riser
- Telephone Riser
- Water Riser
- Water Valve
- Active Natural Gas Riser
- Aband. Nat. Gas Riser
- Sewer Cleanout
- Grated Drain Inlet
- Clarifier
- Power Pole
- Backfilled Excavation
- Junk Pipe
- EM61MK2 Data, Channel 3
  Contour Range: -1500 - 11,500 mV
  Contour Interval: 200 mV

SCALE
0 10ft

FIGURE 4

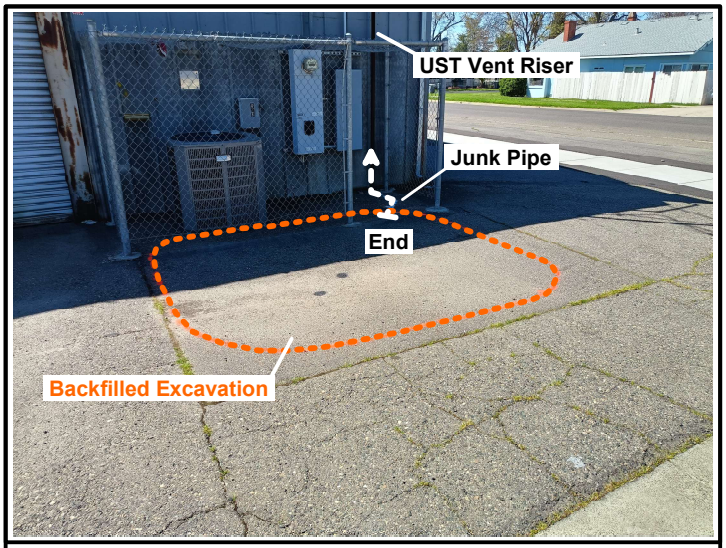


Figure 5

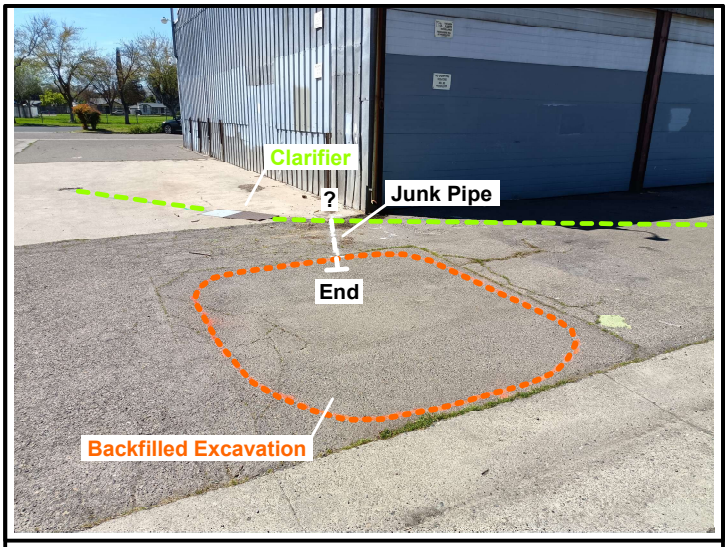


Figure 6

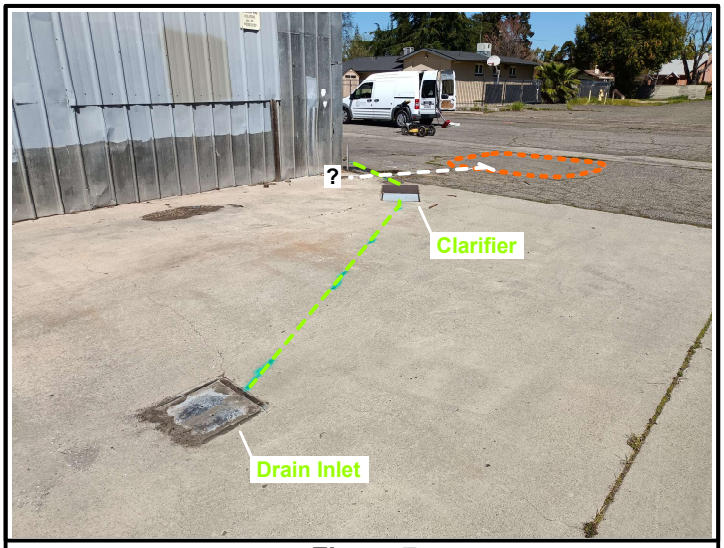


Figure 7

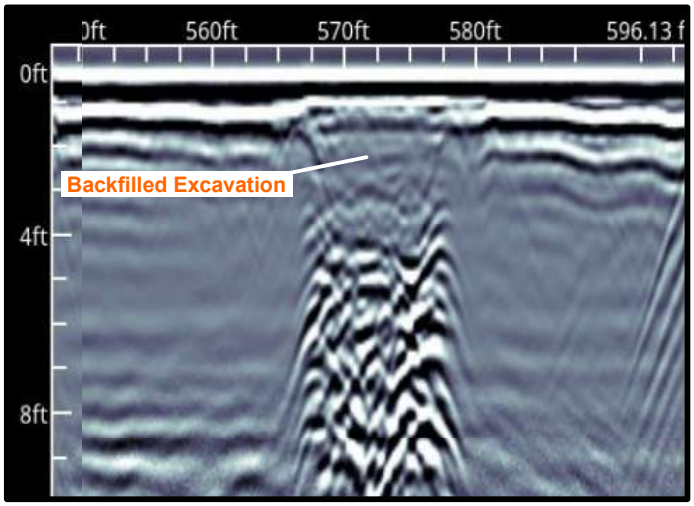


Figure 8

Sub Surface Surveys	SITE: **Former Industrial Building** **2600 K Street** **Merced, California**	TITLE: **Anomaly Photos and Sample Radar Image**	SURVEY DATE: **March 25, 2025**
		PREPARED FOR: **Krazan and Associates**	SSS PROJECT NO: **25-126**