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TETER, LLP
ARCHITECTS ENGINEERS CONNECTED

PROJECT MANUAL

CONTRACTUAL – LEGAL REQUIREMENTS
TECHNICAL SPECIFICATIONS

FOR

Tulare Campus CTE
College of the Sequoias
Sequoia Community College District

Project No.: 21-12032
District Bid No.:
DSA File No.: 54-C2
DSA Appl. No.: 02-120265

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SECTION 000107
SEALS PAGE

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SECTION 011100
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 Owner.
4. Work by separate contracts.
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 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification:

College of the Sequoias
Tulare Campus
Career Technical Education (CTE) facility
4999 Bardsley Ave.
Tulare, CA

Architect’s Project Number: 21-12032
DSA Application Number:

B. Owner:

Sequoias Community College District
915 South Mooney Blvd.
Visalia, CA 93277

Telephone: 559-730-3908
Contact: Byron Woods, byronw@cos.com

C. Architect:

TETER, LLP
1200 Discovery Drive, Suite 160
Bakersfield, California 93309

Telephone 661-843-8400
Contact: Jon Coulter, jon.coulter@teterae.com

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. New construction of a career technical education (CTE) facility consisting of three single storY buildings of approximately 53,000 sf total area; CTE equipment, outdoor education yard, underground utilities, related site work, and other Work indicated in the Contract Documents.

B. Type of Contract: Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

A. General: Where Work is indicated to be by Owner, cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Where Work is indicated to be under a separate contract, 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.

1.7 OWNER-FURNISHED CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:

1. Owner furnished Contractor installed products shall be as indicated on the Drawings.

1.8 ACCESS TO SITE

A. Restricted Use of Site: 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.

1. Project site is the actual area of the Project and does not include existing buildings on the campus, existing parking areas, and existing roadways.

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. Owner Occupancy: Owner will occupy the campus and existing adjacent buildings and site improvements outside of the Project site during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

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

1.10 WORK RESTRICTIONS

A. General: Comply with restrictions on construction operations and with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building 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. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

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

D. 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.

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 Authority having Jurisdiction (AHJ) by the project Architect and shall be approved by the AHJ 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)

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TETER, LLP
ARCHITECTS ENGINEERS CONNECTED

ELECTRONIC DATA FILE DISTRIBUTION WAIVER OF LIABILITY

TETER, LLP
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

Alternates to be determined at the time of bid.

Alternates to be approved by the Division of the State Architect.

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 Architect 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)

FOR BID ONLY

TETER, LLP
ARCHITECTS ENGINEERS CONNECTED

SUBSTITUTION REQUEST FORM

FOR: COS Tulare Campus CTE

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.

B. Division of the State Architect (DSA) Interpretation of Regulations IR A-6 “Construction Change Document Submittal and Approval Process,” latest edition (This document is available on DSA’s website).

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications including the following:

1. Governing Agency requirements.
2. Architect’s Supplemental Instructions.
3. Architect’s Change Directive.
4. Proposal Requests.
5. 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.

B. Change Order (CO): A document defining Contract Modifications. Change Orders shall be issued by the Architect and shall be signed by the Architect, Owner, and Contractor.

C. Construction Change Document (CCD): A form required by DSA for documentation of changes to the DSA approved Construction Documents.

D. Architect’s Change Directive (ACD): A form utilized by the Architect directing the Contractor to proceed with a change that may or may not require DSA approval.

E. Architect's Supplemental Instruction (ASI): For minor changes in the Work not involving adjustment to the Contract Sum or the Contract Time, the Architect will issue Architect's Supplemental Instructions authorizing such changes.

1.4 CHANGES TO DSA APPROVED CONSTRUCTION DOCUMENTS

A. Division of the State Architect: For projects under the jurisdiction of the Division of the State Architect (DSA), Changes to the Construction Documents shall be reviewed and approved by DSA. Changes to the Construction Documents shall be submitted to DSA by the Architect, submittals for changes shall include DSA Form 140 "Application for Submittal of Post-Approval Document."

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 ARCHITECT'S SUPPLEMENTAL INSTRUCTION

A. Architect's Supplemental Instruction (ASI): For minor changes in the Work not involving adjustment to the Contract Sum or the Contract Time, the Architect will issue Architect's Supplemental Instructions authorizing such changes.

1. Architect's Supplemental Instructions affecting changes to the Construction Documents shall be subject to governing agency review and approval, and shall be accompanied by appropriate DSA CCD documentation.
2. Contractor's Response:

a. Contractor shall perform the work indicated in the Architect's Supplemental Instruction without adjustment to the Contract Sum or the Contract Time.
b. 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 Proposal Request.

1.6 ARCHITECT'S CHANGE DIRECTIVE

A. Architect's Change Directive (ACD): Architect may issue an Architect's Change Directive on Architect's standard form to instruct Contractor to proceed with a change in the Work for subsequent inclusion in a Change Order.

1. Architect's Change Directive contains 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.

2. Architect's Change Directives affecting structural, fire/life safety, and/or access compliance shall be accompanied by appropriate approved DSA CCD documentation.
3. Architect's Change Directive shall be issued by the Architect and shall be signed by the Architect.

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.

1.7 PROPOSAL REQUESTS

A. General: Proposal Requests allow the Contractor to respond to proposed changes in the Work that involve an adjustment to the Contract Sum or the Contract Time. Proposal Requests are not instructions to stop work in progress or execute proposed changes. Upon Owner's approval of a Proposal Request, Architect will issue a Change Order instructing the Contractor to proceed with the proposed changes (Refer to Part 1 Article "Change Order Procedures").

B. Architect/Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Contractor's Response: Within time specified in Proposal Request, or not more than 7 days after receipt of Proposal Request when not otherwise specified, 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.

C. Contractor-Initiated Proposals: If conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect. Architect will not act on any Contractor Initiated Proposals until 7 days following the submission of the Schedule of Values per Division 01 Section “Payment Procedures.”

1. Include a statement outlining reasons for the change 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.
2. 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.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. 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.
6. 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.
7. Proposal Request Form: Use form acceptable to Architect.

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

1. Issue a Change Order 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.

1.8 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on form provided by Architect.

1. Change Orders affecting changes to the Construction Documents shall be subject to governing agency review and approval, and shall be accompanied by appropriate DSA CCD documentation.

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;” Interpretive Regulations (IRs); A- Administrative; IR-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

FOR BID ONLY

Project:
Project Title COS Tulare Campus CTE
TETER Project No. 12032
125 S. Bridge St. #150
Visalia, CA 93291

Client Project No.

DSA File No. 54-C2

DSA Appl No. 02-120265

Date:

Request for Information No. _____

☐ Deviation from Contract Docs

☐ Correction of Non-Compliant Work

From:
Name
Company Name

To:
Name
Title or Department
TETER
125 S. Bridge St. #150
Visalia, CA 93291

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, Project Inspector, 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, Project Inspector, 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, Project Inspector, 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, Project Inspector, 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, Project Inspector, 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, Project Inspector, 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, Project Inspector, 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 and interim milestones.
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. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
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. Use of premises restrictions.
    d. Seasonal variations.
    e. 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. Immediately 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 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, Project Inspector, 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.

B. Related Sections:

1. Division 31 Section "Site Clearing" for photographic documentation before site clearing operations commence.

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 2019 California Administrative Code, Section 4-336. 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, 2019 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, 2019 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, 2019 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. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
15. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
16. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.

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. FED-STD - Federal Standard; (See FS).
3. 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.
4. USAB - United States Access Board; www.access-board.gov.
5. 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. DSA; Division of the State Architect.
7. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
8. 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 “Fire Safety During Construction” for fire safety requirements during construction.

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: Install temporary water service, including meter, and pay for use charges for water used by all entities for construction operations.

C. Electric Power Service: Install temporary electric power service, including meter, and pay for use charges for electricity used by all entities for construction operations.

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 NFPA 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. 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.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

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 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/bookcase, 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.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas 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. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Project Address Sign: Provide temporary project address sign as required by Authority having Jurisdiction.

3. 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.

4. 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."

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, 2019 Edition, Chapter 33 “Fire Safety During Construction and Demolition” and the 2019 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. Standpipes (CFC 3313):

1. Where Required: In buildings required to have standpipes by California Fire Code Section 905.3.1, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction where the floor level of the highest story is located more than 30 feet above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to stairways complying with California Fire Code Section 3311.11. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.
2. Buildings Being Demolished: Where a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.
3. Detailed Requirements: Standpipes shall be installed in accordance with the provisions of California Fire Code Section 905.

    a. Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes comply with the requirements of California Fire Code Section 905 as to capacity, outlets and materials.

M. Automatic Sprinkler System (CFC 3314):

1. Completion Before Occupancy: In buildings where an automatic sprinkler system is required by the California Fire Code or California Building Code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in California Fire Code Section 105.3.4.

2. Operation of Valves: In buildings where an automatic sprinkler system is provided, operation of sprinkler control valves shall be allowed only by properly authorized personnel and shall be accompanied by notification of duly designated parties. Where the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

N. 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.

O. 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.

P. 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 and issued in the name of the Owner or endorsed by manufacturer to 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 Division 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. Field engineering and surveying.
3. Installation of the Work.
4. Cutting, patching and repairing.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "Summary of Work" for coordination of Owner furnished products and/or Owner performed work, and limits on use of Project site.
2. Division 01 Section "Submittal Procedures" for submitting surveys.

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 SUBMITTALS

A. Survey: Submit survey stamped and signed by land surveyor or professional engineer of elevations, slopes, and cross slopes of accessible routes and certify that accessible routes comply with disabled access requirements.

1. Survey shall be a separate submittal and shall also be included in the Project Record Documents.

1.5 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.

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

PART 3 - EXECUTION

3.1 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 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.

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. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

B. Survey of Accessible Routes: On completion of site improvements, prepare a topographic survey of accessible routes showing dimensions, locations, and elevations of accessible features in order to certify compliance with requirements for disabled access. Survey shall be limited to site features included in the Work of the Project.

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

K. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

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

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. 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. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

E. 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.

F. 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 OWNER-INSTALLED PRODUCTS

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

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 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.

3.9 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."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

B. 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.

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 and demolition waste.
2. Recycling nonhazardous construction and demolition waste.
3. Disposing of nonhazardous construction and demolition waste.

B. Related Requirements:

1. Division 04 Sections as applicable to masonry for disposal requirements for masonry waste.
2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

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

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

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

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

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

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

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and 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 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use separate forms for construction waste and demolition waste. 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.

G. Qualification Data: For waste management coordinator.

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 and demolition waste in accordance with one of the following 2019 California Green Standards Code (GBSC) Sections, or meet a local construction and demolition 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 and demolition waste management ordinance that is more stringent, provide Waste Management Plan that:

   a. Identifies the construction and demolition 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 and demolition waste materials will be sorted on-site (source separated) or bulk mixed (single stream).
   c. Identifies diversion facilities where construction and demolition waste material collected will be taken.
   d. Specifies the amount of construction and demolition 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 and demolition 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. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

    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 SALVAGING DEMOLITION WASTE

A. General: Contract Documents identify items to be salvaged for reinstallation and items to be salvaged to the Owner; items indicated to be removed become the Contractor's property, Contractor may salvage removed items and offer for sale and/or donation.

B. Salvaged Items for Reuse/Reinstallion in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

C. Salvaged Items to Owner: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Salvaged Items for Sale and/or Donation: Not permitted on Project site.

E. Salvaged Items for Reinstallation or Owner's Use:

1. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
2. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
3. Plumbing Fixtures: Separate by type and size.
4. Lighting Fixtures: Separate lamps by type and protect from breakage.
5. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND 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.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Clean and stack undamaged, whole masonry units on wood pallets.

D. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

3.5 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.

    a. Comply with requirements in Division 32 Sections as applicable to planting for use of clean sawdust as organic mulch.

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

3.6 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 PDF file of Contract Document Drawings with annotated Record Drawing information as follows:

1. Initial Submittal: Architect will review submittal and indicate whether initial submittal is acceptable or if additional information or documentation is needed and will communicate the response to the Contractor.
2. Subsequent Submittal: When initial submittal requires additional information, submit Record Drawings that have been revised to address Architect's comments from the initial or previous submittal. Architect will review submittal and indicate whether submittal is acceptable or if additional information or documentation is needed and will communicate the response to the Contractor.

B. 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

FOR BID ONLY

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 2019 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 2019 California Green Building Standards Code).

B. Outdoor Lighting: Outdoor lighting shall be designed and installed to comply with requirements of the 2019 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 2019 CGBSC, Section 5.303.3.

E. Moisture Control: Irrigation systems shall be designed and installed to prevent spray on buildings; per requirements of the 2019 CGBSC, Section 5.407.2.1.

F. Construction Waste Management: Comply with requirements of the 2019 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 2019 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: 2019 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: 2019 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: 2019 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 2019 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 2019 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.

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 has been prepared by:

BSK Associates
550 West Locust Avenue
Fresno, CA 93650
Ph 559-497-2880

BSK Report No. G21-396-11F, Dated January 31, 2022

B. A copy of the Geotechnical Investigation Report is contained in the Appendix of this Project Manual.

C. The Geotechnical Investigation Report shall be considered to be a part of the Contract Documents. The Contractor shall become familiar and comply with the requirements and recommendations in the Report.

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 024213
STRUCTURE MOVING

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: Moving existing storage structures to designated on-site storage location during construction, moving structures back to final locations at completion of construction, and disconnecting, capping or sealing, and reconnection of building utilities.

B. Related Requirements:

1. Division 01 Section "Summary" for use of the premises and phasing requirements.
2. Division 01 Section "Construction Progress Documentation" for preconstruction photographs taken before building relocation.
3. Division 26 sections as applicable for disconnecting and reconnecting electrical services to buildings to be relocated.

1.3 PREINSTALLATION MEETINGS

A. Structure Moving Conference: Conduct conference at Project site.

1. Inspect and discuss condition of structures to be moved.
2. Review structural load limitations of existing structures.
3. Review and finalize schedule and verify availability of personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for protection of adjacent buildings.

1.4 INFORMATIONAL SUBMITTALS

A. Photographs: Show existing conditions of structures to be moved including finish surfaces, that might be misconstrued as damage caused by moving operations. Comply with Division 01 Section "Photographic Documentation." Submit before the Work begins.

1.5 FIELD CONDITIONS

A. Building(s) to be moved will be vacated and use discontinued before start of the Work.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Hazardous Materials: It is expected that hazardous materials will not be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting structure moving operations.

B. Inventory and record the condition of structures to be moved. Provide photographs or video of conditions that might be misconstrued as damage caused by moving operations. Comply with Division 01 Section "Photographic Documentation.

3.2 UTILITY SERVICES

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving structures to moved.

1. Coordinate shut off of utilities with Owner.
2. Do not start moving operations until utility disconnecting and sealing have been completed and verified in writing.

B. Reconnect utilities once structures have been moved/relocated to final locations.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways and other building facilities during moving operations. Maintain exits from existing buildings.

B. Temporary Shoring: Design, provide, and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of structures to be moved.

3.4 STRUCTURE MOVING

A. Move storage structures intact using methods and equipment to prevent damage to structures.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

3.5 REPAIRS

A. Promptly repair damage to structures to be moved or adjacent buildings caused by structure moving operations.

3.6 CLEANING

A. After moving/relocating structures to final locations, clean structures of dust, dirt, and debris caused by building moving and construction operations. Return adjacent areas to condition existing before structure moving operations began.

END OF SECTION

SECTION 031512
POST INSTALLED CONCRETE ANCHORS

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 types of post installed anchors:

1. Expansion anchors.
2. Sleeve anchors.
3. Drop-in anchors.
4. Adhesive anchors.
5. Capsule anchors.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete."
2. Division 04 Section "Unit Masonry."
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Metal Fabrications."

1.3 REFERENCES

A. ACI:

1. ACI 318 – Building Code Requirements for Structural Concrete
2. ACI 355.2 – Standard for Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete

B. ASTM:

1. ASTM A36 – Standard Specification for Carbon Structural Steel
2. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
4. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
5. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

6. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
7. ASTM B695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
8. ASTM C881 – Standard Specification Epoxy-Resin-Based Bonding Systems for Concrete
9. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
10. ASTM E1512 – Standard Test Methods for Testing Bond Performance of Bonded Anchors
11. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

C. Federal Specifications A-A-1922A, A-A01923A and A-A-55614 for Expansion and Shield-Type Anchors

D. ICC-ES

1. ICC-ES AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
2. ICC-ES AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
3. ICC-ES AC70 – Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements
4. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
5. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include manufacturer's written installation instructions, physical characteristics, and load tables.

B. Evaluation Reports: From ICC-ES or IAPMO ES for each type of post installed anchor indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed post-installed anchor installations similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of not less than 3 years of successful in-service performance.

B. Evaluation Service Approval: Use only products that have current ICC or IAPMO Evaluation Service approval.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to job site in manufacturer's or distributor's packaging undamaged, complete with installation instructions.

B. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Carbon and Alloy Steel Nuts: ASTM A563.

B. Carbon Steel Washers: ASTM F436.

C. Carbon Steel Threaded Rod: ASTM F 1554; or ASTM A193 Grade B7; or ISO 898 Class 5.8.

D. Wedge Anchors: ASTM A510; or ASTM A108.

E. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.

F. Stainless Steel Nuts: ASTM F594.

G. Zinc Plating: ASTM B633.

H. Hot-Dip Galvanizing: ASTM A153.

2.2 POST INSTALLED ANCHORS

A. Basis of Design: Post installed anchors shall be of manufacturer, type, and size as indicated on Drawings; manufacturers indicated on the Drawings are selected from the following:

1. Hilti Corporation.
2. Simpson Strong-Tie Company.

B. Post Installed Anchor Material:

1. Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
2. Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts (Type 304), ASTM F 593, and nuts, ASTM F 594.

C. Expansion Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.

1. Anchorage to Grouted Masonry, provide one of the following:

a. Hilti Kwik Bolt TZ-2, ICC ESR-4561.
b. Simpson Strong-Tie, Strong-Bolt 2 wedge anchor, IAPMO ER-0240.

2. Anchorage to Concrete, provide one of the following:

a. Hilti Kwik Bolt TZ2, ICC ESR-4266 (carbon steel and AISI Type 304 Stainless Steel).
b. Simpson Strong-Tie, Strong-Bolt 2 wedge anchor, ICC ESR-3037.

D. Sleeve Anchors: Torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.

1. Subject to compliance with requirements, provide anchor indicated on Drawings or one of the following:

a. Hilti; HAD-P Undercut Anchor, ICC ESR-1546.
b. Submit Request for Substitution.

E. Drop-in Anchors: Flush, internally threaded shell anchor, bottom bearing type with a slotted single piece steel shell and a tapered expander plug providing 360 degree contact with the base material. Type and size as indicated on Drawings.

1. Subject to compliance with requirements, provide anchor indicated on Drawings or one of the following:

a. Hilti; HDI Drop-in Anchor COLA (City of LA) RR 23709.
b. Submit Request for Substitution.

F. Adhesive Anchors: Two component, all weather, high performance epoxy complying with descriptive requirements of ASTM C 881, Type IV, Grade 3, Classes A, B, and C, except for gel time; mixed and dispensed through motionless, static mixing nozzle and dispensing tool. Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.

1. Anchorage to Grouted Masonry, provide one of the following:

a. Hilti: Threaded rods or steel reinforcing bars with HIT HY-70 Adhesive Anchorage System, ICC ESR-2682.
b. Simpson Strong-Tie: Threaded rods or steel reinforcing bars with SET-XP Adhesive Anchorage System, IAPMO ES-0265.

2. Anchorage to Concrete, provide one of the following:

   a. Hilti: Threaded rods or steel reinforcing bars with HIT RE 500 V3 Adhesive Anchoring System, ICC ESR-3814.
   b. Simpson Strong-Tie: Threaded rods or steel reinforcing bars with SET-XP Adhesive Anchorage System, ICC ESR-2508.

G. Capsule Anchors: Threaded steel rod, inserts and reinforcing dowels with 45 degree chisel point, complete with nuts, washers, glass or foil capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, and manufacturer's installation instructions. Type and size as indicated on Drawings.

   1. Subject to compliance with requirements, provide anchor indicated on Drawings or one of the following:

      a. Hilti HVA Adhesive System with HVU capsules, ICC ER-5369.
      b. Submit Request for Substitution.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine 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.

3.2 INSTALLATION

A. General: Install anchors in accordance with manufacturer's written installation instructions and as indicated on Drawings.

B. Drilling Concrete and Concrete Unit Masonry:

   1. Base Material Strength: Do not drill holes in concrete or masonry until concrete, mortar, and/or grout complies with the following for the type of anchor indicated:

      a. Expansion Anchors: Do not drill base material until base material has cured 28 days minimum.
      b. Adhesive Anchors: Do not drill base material until base material has cured 7 days minimum.

   2. Drill holes with rotary impact hammer drills using carbide-tipped bits and core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete or masonry surface.

      a. Cored Holes: Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer.

b. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.

C. Wedge Anchors, Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Architect.

D. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into 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. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

E. Capsule Anchors: Perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors shall be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

F. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.

2. To facilitate testing and inspection, the Contractor shall:

    a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
    b. Provide access to the Work for the designated Testing and Inspection Agency.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Testing: Each type and size of anchor shall be proof load tested by the independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Structural Engineer. If any anchor fails testing, all anchors of the same type, diameter, and which were installed by the same trade and not previously tested, shall be tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

1. Anchors shall not be tested prior to base material having cured for a minimum of 28 days and achieved design strength.
2. Minimum anchor embedments, proof loads and torques shall be as indicated on the Drawings.
3. Torque shall be applied with a calibrated torque wrench.
4. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.
5. Testing frequency shall be per 2019 CBC 1910A.5.3.

    a. Sill Plate Bolting: Test 10 percent of anchors.
    b. Structural Applications other than Sill Plate Bolting: Test all anchors.
    c. Non-Structural Applications (Equipment Anchorage): Test 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

6. Test acceptance criteria shall be per 2019 CBC 1910A.5.5.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Slabs-on-grade.
3. Concrete raised planter walls.

B. Related Sections:

1. Division 01 Section “Quality and Testing Requirements” for administrative and procedural requirements for quality assurance including independent testing requirements.
2. Division 03 Section "Concrete Cure-Sealer-Hardener.”
3. Division 03 Section "Topical Concrete Vapor Control Barrier.”
4. Division 03 Section "Polished and Stained Concrete Finishing” for concrete slabs that are to be polished and stained.
5. Division 07 Section “Underslab Vapor Retarder.”
6. Division 22 and 23 Sections as applicable to Plumbing and Mechanical items embedded in concrete.
7. Division 26 Sections as applicable to Electrical items embedded in concrete.
8. Division 31 Sections as applicable to earthwork.
9. Division 32 Sections as applicable to concrete paving and site concrete work.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1. Shop drawings shall be in accordance with ACI SP-66 or CRSI “Manual of Standard Practice.”
2. Mill certificates: Steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel. Submit certificates accompanying the Shop Drawings.

D. Construction Joint Layout Shop Drawings: Show locations of proposed construction and control joints other than, or in addition to, those as indicated on the drawings. Location of joints is subject to approval of the Architect.

E. Qualification Data: For the Ready-mixed concrete manufacturer, include copies of applicable ACI certificates.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

G. Material Test Reports: For aggregates, from a qualified testing agency, indicating compliance with requirements:

H. Mill certificates: Steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel. Submit certificates accompanying the Shop Drawings.

I. Steel Reinforcement Record Drawings: Shop drawings shall be corrected to reflect actual field changes and shall be submitted to the Architect.

J. Delivery Tags: Delivery tags for all concrete.

K. Batch Plant Inspection Waiver: When batch plant inspection waiver is requested, evidence of compliance shall be submitted to, and approved by, the Governing Agency; refer to requirements in Part 3 Article “Field Quality Control.”

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills required for work performed under this Section. 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 design.

B. Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer shall be certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency: An independent agency retained by the Owner, acceptable to the Architect, and qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 318-14, “Building Code Requirements for Structural Concrete” with amendments per 2019 California Building Code, Chapter 19A, Section 1905A.
3. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Mockups: Cast concrete slab-on-grade panel to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 200 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.
2. Coordinate mock up with concrete finishing and polishing Work.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, joint-filler strips, and semirigid joint fillers.
c. Vapor-retarder installation.
d. Steel reinforcement installation.
e. Anchor rod and anchorage device installation tolerances.
f. Cold and hot weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Shoring and reshoring procedures.
k. Methods for achieving specified floor and slab flatness and levelness.
l. Floor and slab flatness and levelness measurements.
m. Concrete repair procedures.
n. Concrete protection.
o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
p. Protection of field cured field test cylinders.
q. Concrete mixtures, finishing, and curing of slabs to receive a polished finish.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Identification: Bundle and tag reinforcing steel with grades and suitable identification marks for checking, sorting and placing. Use waterproof tags and markings and do not remove until steel is in place.

1.7 COORDINATION

A. Slab Finishes: Coordinate slab finish requirements with trades installing or applying floor finishes or treatments over slabs. Finishes shall include but not be limited to concrete sealing, topical concrete vapor control barrier, ceramic tile, resinous/fluid applied floor systems, adhered resilient floor systems, and adhered carpet.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Earth Forms: Use for sides of footings only where soil is firm and stable and concrete will not be exposed. Where earth forms are used, cut excavations neat and accurate to size for placing concrete directly against the excavation.

B. Rough-Formed Finished Concrete: Use for formed concrete that will not be exposed in the finished work, fabricate forms of plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Smooth-Formed Finished Concrete: Use for formed concrete that will be exposed in the finished work, fabricate forms of form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

D. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. Slabs on Grade and Foundations: Use precast concrete blocks, plastic-coated steel with bearing plates or specifically designed wire-fabric supports fabricated of plastic. Precast blocks shall be not less than 3 inches by 3 inches square and shall have a compressive strength equal to or greater than the strength of the surrounding concrete.
2. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

F. Fabricating Reinforcement: Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" or ACI SP-66 and the details shown on the Drawings.

1. In the case of fabricating errors, do not rebend or straighten reinforcement in a manner that will damage or weaken the material.
2. Bends shall be made cold using pin sizes as recommended ACI 318 as modified by T24, CCR, Part 2.
3. Unacceptable Work: Reinforcement with any of the following defects will not be permitted:

   a. Bar lengths, depths, and bends exceeding specified fabrication tolerance.
   b. Bends or kinks not indicated on the project Drawings or the final Shop Drawings.
   c. Bars with reduced cross-section due to excessive rusting or other cause.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II, gray.

   a. Fly Ash: ASTM C 618, Class F. The use of a quality fly ash will be permitted as a cement-reducing admixture up to a maximum of 15% of the weight of portland-cement.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Where concrete expansion from alkali silica or alkali carbonate reactions is anticipated, provide aggregate with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
2. Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall conform to the grading requirements of ASTM C33.

3. Coarse aggregate: Coarse aggregate shall consist of a clean, hard, fine grained, sound crushed rock, or washed gravel or a combination of both. It shall be free from oil, organic matter, or other deleterious substances. Aggregate shall be uniformly graded from one-quarter inch size to maximum size.
4. The maximum size of aggregates used in the project shall be consistent with the dimensions and form of the section being placed, the location and spacing of the reinforcing bars, and with the method of compaction, and shall be such as will produce dense and uniform concrete free from rock pockets, honey-comb and other irregularities. The nominal maximum size of the aggregate shall not be more than one-fifth the narrowest dimension between forms, one-third the depth of slabs nor three-fourths the minimum clear spacing between reinforcing bars.
5. Combined Grading: The combined grading shall be such that the percentage by weight of the combined aggregates shall fall within the limits established as follows:

Sieve number or size in inches (maximum)	Percentage by Weight		
	1-1/2”	1”	3/4”
Passing a 2 inch	---	---	---
Passing a 1-1/2 inch	95-100	---	---
Passing a 1 inch	70-90	90-100	---
Passing a 3/4 inch	50-80	70-95	90-100
Passing a 3/8 inch	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28
Passing a No. 50	2-12	5-15	5-15
Passing a No. 100	0-3	0-5	0-5

6. Special grading or size limitations: When reviewed and approved by the Architect, other gradings or maximum size limitations may be used if mixes are designed and tested in accordance with the concrete mixture specified in the “Concrete Mixtures” Article.
7. Soundness of Aggregates: Both the coarse and fine aggregate shall be tested by the use of a solution of sodium or magnesium sulfate, or both, whenever in the judgment of the Architect, such tests are necessary to determine the quality of the material. Such tests shall be performed in accordance with ASTM C88 and the results shall show compliance with the limits set forth in ASTM C33.
8. Reactivity: Aggregates shall be free from any substance which may be deleteriously reactive with the alkalies in the cement in an amount sufficient to cause excessive expansion of the concrete or which will interfere with normal hydration of the cement. Acceptability of the aggregate shall be based upon satisfactory evidence that the aggregate is free from such materials.

9. Aggregates shall be tested, when required by the Architect prior to the concrete mix being established, in accordance with the following specifications:

Test	Specification
Abrasion	ASTM C131 and C535
Gradation	ASTM C136
Alkali Reactivity	ASTM C289 and C227
Organic Impurities	ASTM C40
Clay Lumps	ASTM C142

10. Maximum Coarse-Aggregate Size: Nominal size as indicated on Drawings.
11. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Admixtures shall be reviewed and approved by the Architect and the Division of the State Architect.

B. Admixtures for concrete slabs to receive a polished finish shall be limited to, and coordinated with, Division 03 Section “Polished Concrete Finishing.”

C. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Certification of requirements and chloride ion content is required from the admixture manufacturer prior to mix design review.

1. Air-entraining Admixture: ASTM C260.

   a. Available Products: Subject to compliance with requirements, provide one of the following products:

      1) Euclid Chemical Company (The); Air Mix.
      2) BASF/Master Builders, Inc.; Micro-Air.
      3) Sika Corporation; Sika AER.

2. Water-reducing Admixtures: ASTM C494 Type A.

   a. Available Products: Subject to compliance with requirements, provide one of the following products:

      1) Euclid Chemical Company (The); Eucon WR-75.
      2) BASF/Master Builders Inc.; Pozzolith 220N.
      3) Sika Corporation; Plastocrete 161.

3. Water-reducing, Retarding Admixtures: ASTM C494 Type D.

   a. Available Products: Subject to compliance with requirements, provide one of the following products:

      1) Euclid Chemical Company (The); Eucon Retarder-75.
      2) BASF/Master Builders Inc.; Pozzolith 300 R.
      3) Sika Corporation; Plastiment.

4. High Range Water-Reducing Admixture (HRWR): ASTM C494 type F or G.

   a. Available Products: Subject to compliance with requirements, provide one of the following products:

      1) Euclid Chemical Company (The); Eucon 37.
      2) BASF/Master Builders Inc.; Rheobuild 1000.
      3) Sika Corporation; Sikament 300.

   b. When more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A, D and E) may be used.

5. Non-Corrosive, Non-Chloride Accelerator: ASTM C494 Type C or E.

   a. Available Products: Subject to compliance with requirements, provide one of the following products:

      1) Euclid Chemical Company (The); Accelguard 80.
      2) BASF/Master Builders Inc.; Pozzutec 20+.
      3) Sika Corporation, Plastocrete 161FL.

   b. The admixture manufacturer shall have long-term (more than one year duration) non-corrosive test data on metal deck and reinforcing steel from an independent testing laboratory using an acceptable accelerated corrosion test method such as using electrical potential measures.

2.5 CURING AND SEALING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

   1. Products: Subject to compliance with requirements, provide one of the following:

      a. BASF Construction Chemicals - Building Systems; Confilm.
      b. ChemMasters; SprayFilm.
      c. Conspec by Dayton Superior; Aquafilm.
      d. Dayton Superior Corporation; Sure Film (J-74).
      e. Edoco by Dayton Superior; BurkeFilm.
      f. Euclid Chemical Company (The), an RPM company; Eucobar.
      g. Lambert Corporation; LAMBCO Skin.

h. L&M Construction Chemicals, Inc.; E-CON.
i. Meadows, W. R., Inc.; EVAPRE.
j. Sika Corporation; SikaFilm.
k. Symons by Dayton Superior; Finishing Aid.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, clear or white polyethylene film, 6 mil minimum thickness, or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Kure 200.
b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior; W.B. Resin Cure.
d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
e. Edoco by Dayton Superior; Res X Cure WB.
f. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
g. L&M Construction Chemicals, Inc.; L&M Cure R.
h. Meadows, W. R., Inc.; 1100-CLEAR.
i. Symons by Dayton Superior; Resi-Chem Clear.

2. Curing compounds are subject to removal after curing period has elapsed; refer to Part 3 Article “Concrete Protecting and Curing.”

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Kure 1315.
b. ChemMasters; Polyseal WB.
c. Conspec by Dayton Superior; Sealcure 1315 WB.
d. Edoco by Dayton Superior; Cureseal 1315 WB.
e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f. Meadows, W. R., Inc.; Vocomp-30.
g. Symons by Dayton Superior; Cure & Seal 31 Percent E.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: As specified in Division 07 Section “Underslab Vapor Retarder,” ASTM E 1745, Class A, 15 mil thickness minimum.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301, ACI 318, Chapter 26, and Chapter 19A of the California Building Code.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

   a. The testing agency used for preparing mixture designs shall be different from the testing agency retained by the Owner for testing concrete strength and materials.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash:

   a. Footings: 15 percent.
   b. Slabs-on-Grade: 10% maximum for concrete floor slabs to be polished.

C. Limit water-soluble, chloride-ion content in hardened concrete to the following percentages by weight of cement.

1. Prestressed concrete: 0.06 percent.
2. Reinforced concrete exposed to chloride in service: 0.15 percent.
3. Reinforced concrete that will be dry or protected from moisture in service: 1.00 percent.
4. Other reinforced concrete: 0.30 percent.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing 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, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as indicated on Drawings for strength, slump, water/cement ratio, and maximum aggregate size.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Project site mixing of structural concrete will not be permitted. Project site mixing of concrete for other purposes may be permitted only when reviewed and approved by the Architect. When allowed, measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ACI 318. Mix concrete materials in appropriate drum-type batch machine mixer, the capacity of the mixer shall be such that it will handle one or more full sack batches.

C. Control of Admixtures:

1. Admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.
2. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.
3. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first.
4. Admixtures shall be used in accordance with the manufacturer's instructions.

D. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be discarded.

E. When concrete arrives at the project with slump below that suitable for placing, as indicated by the specifications, water may be added only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. An addition of water shall be accompanied by a quantity of cement sufficient to maintain the proper water-cement ratio. Such addition shall be reviewed by the Architect.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

1. Where earth is used for forming sides of footings, increase the width of footings by 1 inch on each side of the footing.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

B. Conduits and Pipes Embedded in Concrete:

1. Pipes, other than conduits for electrical circuits, shall not be embedded in structural concrete unless specifically reviewed and approved by the Architect and the Division of the State Architect. Any pipe or conduit may pass through any walls or floor slab by means of a sleeve so located that it does not impair the strength of the structure. Openings larger than 12 inches in any dimension shall be as detailed on the structural plans.
2. Unless otherwise approved, embedded pipes or conduits, other than those merely passing through, shall be not larger in outside dimension than one-third the thickness of the slab, wall, or beam in which they are embedded, nor shall they be spaced closer than three diameters or widths on center and shall have at least 1-1/2 inches concrete cover.
3. Sleeves, pipes, or conduits of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Vapor retarders shall be installed in accordance with the requirements of Division 07 Section “Underslab Vapor Retarder.”

3.5 STEEL REINFORCEMENT

A. Quality Control: Reinforcement steel and placement shall be subject to inspection and testing per Part 3 Article “Field Quality Control.”

B. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Coordinate installation of steel reinforcement with installation of vapor barrier specified in Division 07 Section “Underslab Vapor Retarder.”
2. Do not cut or puncture vapor retarder; if cut or damaged, vapor barrier shall be repaired in accordance with Division 07 Section “Below Grade Vapor Retarder.”

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

   a. Use only grooved joints for concrete surfaces that will be permanently exposed to view.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

    a. Sawn joints shall not be used for concrete surfaces that will be permanently exposed to view.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. 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.

3.7 CONVEYING

A. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

B. Conveying equipment shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:

1. Truck mixers, agitators and non-agitating units and their manner of operation shall conform to the applicable requirements of ASTM C94.
2. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. A suitable device shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
3. Do not use reinforcement or reinforcement supports to support runways for concrete conveying equipment.

C. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

D. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy. When the concrete is placed into final position by means of pumping, the pumping method for placing concrete shall be reviewed and approved by the Architect and the Division of the State Architect at least one week prior to placing the concrete.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

1. Reposition any misaligned reinforcement.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. 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.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 305 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not permanently exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces permanently exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Finishing of concrete floor slabs to receive a polished finish shall be coordinated with division 03 Section “Polished Concrete Finishing.”

C. Slab Finishes: Provide finished slab surfaces as indicated below; confirm and coordinate surface finishes for adhered and fluid applied floor finishes with trades installing/applying respective floor systems required for the project conditions.

	Finish Floor Application	Slab Finish Type
1.	Surfaces to receive mortar setting beds for tile flooring and similar applications.	Scratch Finish
2.	Surfaces to receive thinset tile flooring directly over concrete	Trowel and Fine Broom Finish
3.	Surfaces to receive adhered carpet, resilient sheet, or resilient tile flooring	Trowel and Fine Broom Finish
4.	Surfaces to receive epoxy or polyurethane fluid applied flooring	Light Broom Finish (Confirm with floor system manufacturer)
5.	Surfaces to be exposed and sealed concrete	Troweled Finish
6.	Ramped exposed concrete	Medium Broom Finish
7.	Surfaces to receive waterproof membranes	Floated Finish
8.	Surfaces to receive a polished finish; Coordinate with Division 03 Section “Polished Concrete Finishing.”	Smooth trowel finish, not burned

D.

E. Slab Flatness (F_F) and Levelness (F_L): Provide finished slab flatness and levelness as indicated below; confirm and coordinate surface finishes for floor finishes with trades installing/applying respective floor systems required for the project conditions.

	Application		Flatness (F_F)	Levelness (F_L)
1.	Slabs to receive polished concrete finish, Coordinate with Division 03 Section "Polished Concrete Finishing."	Overall: Local:	50 40	30 20
2.	Slabs to receive resilient flooring	Overall: Local:	30 24	25 15
3.	Slabs to receive carpet flooring	Overall: Local:	25 17	20 15
4.	Other areas not specified	Overall: Local:	25 17	20 15

F. Sloped Slab Finishes: Where slabs are indicated to be sloped, finished slabs shall have a slope not to exceed 1/4 inch per one foot unless otherwise indicted on the Drawings.

G. Slab Finish Types: Slab finish types shall be as follows:

1. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
2. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing.
3. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Trowel and Fine-Broom Finish: After applying a trowel finish and while concrete is still plastic, slightly scarify surface with a fine broom to produce a fine directional finish.
5. Broom Finish: Immediately after float finishing, slightly roughen surface by brooming with fiber-bristle broom perpendicular to main traffic route and/or ramp surfaces. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. 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: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days using a water saturated absorptive cover kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

    a. This method shall not be used on floor slabs receiving adhered floor systems, fluid applied floor systems, or sealers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

    1. Defer joint filling as long as possible and until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half 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. Perimeters of cut areas shall be square or rectangular in shape with cuts vertical and horizontal.
    d. Clean, dampen with water, and brush-coat holes and voids with bonding agent. 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 will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include 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.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer

according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. 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.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the concrete construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.

b. Provide access to the Work for the designated Testing and Inspection Agency.
c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.
d. Provide and maintain for the sole use of the Testing and Inspection Agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hr. as required by ASTM C31.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspection Services:

1. Testing and inspections shall be performed by the designated Testing and Inspection Agency.
2. Testing and inspections shall be in accordance with the 2019 California Building Code, Section 1705A.3 and Table 1705A.3, DSA Statement of Structural Tests and Inspections form DSA 103, Structural Drawings Special Inspection Criteria, and shall include but not be limited to the following:

a. Inspection of steel reinforcement.
b. Inspection of headed bolts and studs prior and during concrete placement.
c. Verification of use of required design mixture.
d. Sampling of concrete for strength tests, slump, air content, and temperature of concrete at time of placement.
e. Inspection of concrete placement, including conveying and depositing.
f. Inspection of curing procedures and maintenance of curing temperature.
g. Verification of concrete strength before removal of shores and forms from beams and slabs.
h. Inspection of formwork.

E. Sampling and Testing of Steel Reinforcement:

1. Samples of reinforcing steel shall be taken by a designated approved testing agency at place of distribution prior to shipment or at project site.
2. Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number and provided the mill analyses accompany the report, one tensile test and one bend test shall be made from a specimen from each 10 tons or fraction thereof of each size of reinforcing steel.

a. Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2-1/2 tons or fraction thereof of each size of reinforcing steel.

3. Each sample shall consist of no fewer than two pieces, each 18 inches long, of each size and grade or reinforcing steel.

F. Batch Plant Inspection: The quality and quantity of materials used in transit mixed concrete and in batched aggregates shall be continuously inspected at the location where materials are measured by an approved Testing and Inspection Agency.

1. Waiver of Batch Plant Inspection: Batch plant inspection will not be required under the following conditions:

   a. The concrete plant complies fully with the requirements of ASTM C94, Sections 8 and 9, and has a current certificate from the National Ready Mixed Concrete Association. The certification shall indicate that the plant has automatic batching and recording capabilities.
   b. The Testing Agency shall check the first batching at the start of work and furnish mix proportions to the licensed weighmaster.
   c. Licensed weighmaster shall positively identify materials as to quantity and certify to each load by a ticket.
   d. Tickets shall be transmitted to the Contractor by cement truck driver with load identified thereon. Do not accept loads without a load ticket identifying the mix; Contractor shall keep a daily record of placements identifying each truck, its load and time of receipt, and approximate location of deposit in the structure and will transmit a copy of the daily record to the Architect.
   e. At the end of the project, the weighmaster shall furnish an affidavit to the Architect certifying that all concrete furnished conforms in every particular to proportions established by mix designs.
   f. The Testing Agency shall certify and submit evidence of compliance to the governing agency Division of the State Architect and obtain governing agency's approval prior for a waiver of batch plant inspection prior to mixing the concrete.

G. Placement Record: A record shall be kept on-site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the governing agency (Division of the State Architect).

H. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture but not less than one sample for each 50 cu. yd. or fraction thereof and one sample for each 2,000 square feet of slab area.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; 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. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; 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 C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at 7 days for information and two cured specimens at 28 days for strength acceptance, the fourth specimen shall be held in reserve in case additional testing in necessary.

    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28-day tests.
9. 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.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
11. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

    a. The cost of additional testing and inspection of replaced work will be paid for by the Owner with the amount being deducted from the Contract Amount by a Change Order.

3.17 PROTECTION OF SEALED FLOORS

A. Protect sealed floor surfaces from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by floor treatment installer.

END OF SECTION

SECTION 033518
CONCRETE CURE-SEALER-HARDENER

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. Single application cure-sealer-hardener for new concrete floors.
2. Single application sealer-hardener for cured concrete floors.
3. Precautions for avoiding staining concrete before and after application.

B. Related Sections:

1. Division 03 Section “Cast-In-Place Concrete.”

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
3. ASTM C805 Standard Test Method for Rebound Number of Hardened Concrete.
4. ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
5. ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test.
6. ASTM G23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000).

1.4 SUBMITTALS

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

B. Qualification Data: For qualified installer.

C. Maintenance Data: Maintenance instructions, including precautions for avoiding staining after application.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is certified in writing by manufacturer as qualified to install manufacturer's products.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

1.6 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

C. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

PART 2 - PRODUCTS

2.1 CURE-SEAL-HARDENER

A. Basis of Design: Drawings and Specifications are based on the following:

1. Curecrete Distribution, Inc.; Ashford Formula.

a. Subject to compliance with requirements, submit specified product or a comparable product subject to request for substitution.

B. Cure-Seal-Hardener: Water-based chemically reactive penetrating sealer and hardener that seals by densifying concrete so that water molecules cannot pass through but air and water vapor can, and allows concrete to achieve full compressive strength, minimizing surface crazing and eliminating dusting.

1. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779.
2. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
3. Hardening: As follows when tested in accordance with ASTM C39:

a. After 7 Days: An increase of at least 40% over untreated samples.
b. After 28 Days: An increase of at least 38% over untreated samples.

4. Coefficient of Friction: 0.86 dry, 0.69 wet when tested in accordance with ASTM C1028.
5. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.

6. Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G23.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for conditions affecting performance of the Work of this Section.

B. Proceed with application only after unsatisfactory conditions have been corrected.

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.

C. Do not use frozen material. Thaw and agitate prior to use.

D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

3.3 INSTALLATION

A. General: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

1. Apply cure-seal-hardener to exposed interior concrete floor slabs indicated to have a sealed concrete finish.

B. New Concrete: Apply cure-seal-hardener to new concrete as soon as the concrete is firm enough to work on after troweling.

1. Spray on at rate of 200 ft^2/gal (5 m^2/L).
2. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 minutes without allowing it to dry out or become slippery. In hot weather, slipperiness may appear before the 30 minute time period has elapsed, if slipperiness occurs, apply additional cure-seal-hardener as needed to keep the entire surface in a non-slippery state for the first 15 minutes. For the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.
3. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.

4. Wait for surface to become slippery again, and then flush entire surface with water to remove all cure-seal-hardener residue.
5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.
6. Wet vacuum or scrubbing machines may be used in accordance with manufacturer's instructions to remove residue.

C. Existing or Cured Concrete: Apply cure-seal-hardener only to clean bare concrete.

1. Thoroughly remove previous treatments, laitance, oil and other contaminants.
2. Saturate surface with cure-seal-hardener; re-spray or broom excess onto dry spots.
3. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 to 40 minutes.
4. If most of the material has been absorbed after the 30 minute soak-in period, remove all excess material, especially from low spots, using broom or squeegee.
5. If most of the material remains on the surface after the 30 minute soak-in period, wait until the surface becomes slippery and then flush with water, removing all cure-seal-hardener residue. Squeegee completely dry, flushing any remaining slippery areas until no residue remains.
6. If water is not available, remove residue using squeegee.

3.4 PROTECTION

A. Protect installed floors for at least 3 months until chemical reaction process is complete.

1. Do not allow traffic on floors for 3 hours after application.
2. Do not allow parking of vehicles on concrete slab.
3. If vehicles must be temporarily parked on slab, place dropcloths under vehicles during entire time parked.
4. Do not allow pipe cutting using pipe cutting machinery on concrete slab.
5. Do not allow temporary placement and storage of steel members on concrete slabs.
6. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.
7. Clean floor regularly in accordance with manufacturer's recommendations.

END OF SECTION

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; polish level indicated at the end of this section in Part 3 Article “Polished Concrete Floor Finish Level.”

B. Related Sections:

1. Division 03 Section "Cast-Place Concrete" for concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing.

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.

1. 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.
2. Gloss Level: Level 2, satin gloss/low sheen, 400 grit.

END OF SECTION

SECTION 033910
TOPICAL CONCRETE VAPOR CONTROL BARRIER

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 surface applied penetrating moisture barrier treatments for newly poured and existing cured concrete slabs on grade.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for concrete mixtures, placement, and finishing.
2. Division 09 Section "Flooring Moisture and Alkalinity Testing" for concrete slab moisture and alkalinity testing.
3. Division 09 Sections as applicable to adhered floor systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer's specification data, installation instructions, and statement of VOC content.

B. Reports: Laboratory test reports.

C. Digital Photographs: Digital photography of completed installation, including surface preparation of concrete slabs.

D. Qualification Data: For qualified Applicator.

E. Field quality-control reports by manufacturer's technical representative.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Limitations: Proceed with application only when existing and forecasted weather and substrate conditions permit product to be applied according to manufacturers' written instructions and warranty requirements.

1. Do not apply when concrete surface temperatures are below 40 degrees F or above 90 degrees F; concrete surface temperatures shall not exceed these limits prior, during and after application for 48 hours.
2. Do not apply products to unprotected surfaces or when water has accumulated on the surface of the concrete.
3. Allow continuous ventilation and indirect air movement during application and curing process.

1.6 COORDINATION

A. Coordinate with Work of the following Sections:

1. Division 03 Section “Cast-in-Place Concrete:”

   a. Review concrete mixture design; water/cement ratio shall not exceed 0.44 for concrete slabs on grade.
   b. Review finishing of concrete slabs; slabs shall be finished as specified by topical vapor control barrier manufacturer.

2. Division 07 Section “Underslab Vapor Retarder:” Concrete slabs-on-grade shall be poured directly over a vapor barrier complying with ASTM E1745, Class A requirements and having a permeance rating not exceeding 0.025 Perms per ASTM E96.
3. Division 09 Section “Flooring Moisture and Alkalinity Testing:” Review and coordinate preparation of concrete slabs on grade with testing requirements and preparation procedures.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail to maintain requirements specified in "Performance Requirements" Article within specified warranty period.

1. In the event floor coverings are damaged due to failure of products or application of products specified in this Section and independent testing results verify water vapor emission and/or alkalinity values in excess of the limits specified, manufacturer and installer shall repair or replace barrier, floor coverings, wall base, adhesives, and patching compounds at no cost to Owner. Warranty shall not list upper moisture or alkalinity levels. Warranty shall not exclude cracks, concrete cohesive failure, ACI 318, ACI 201, dew point, concrete salts or silicates contamination.

B. Warranty Period: Fifteen (15) years from date of Substantial Completion.

C. Liability Insurance: Manufacturer shall provide product liability insurance in the amount of one million dollars ($1,000,000) per occurrence, listing Architect and Owner as additional insured. Sub-contractor general liability certificates are not acceptable.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content of Floor Coatings and Primers: Floor coatings and primers must not exceed VOC content limits established by South Coast Air Quality Management District (SCAQMD) Rule 1113 Architectural Coating when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24).

1. Floor Coatings and Primers: 100 g/L.

2.2 TOPICAL CONCRETE VAPOR CONTROL BARRIERS FOR NEW CONCRETE

A. Description: Two-Component, spray applied product for application to newly poured concrete slabs on grade during final troweling process and designed to suppress water vapor emission, alkalinity, and relative humidity rates from concrete. Material shall be a polymer (non-silicate) based penetrating, film forming barrier that remains compatible with flooring adhesives.

1. Basis of Design: Drawings and specifications are based on the following:

a. Synthetics International; Synthetic 10TR.

1) Subject to compliance with requirements, provide the product indicated or an equivalent product subject to request for substitution.

2. Performance Requirements: Applied product systems shall meet performance requirements indicated without failure due to defective manufacture or installation.

a. Relative Humidity: Suppress 100 percent relative humidity in accordance with ASTM F2170.

b. Water Vapor Transmission Rate (WRT), ASTM E96:

1) Grains/sf/hour: 0.60 to 1.0 or less.
2) Pounds/1,000 sf/24 hours: 2.0 to 3.3 or less.
3) Grams/hour per square meter: 0.40 to 0.70 or less.

c. Water Vapor Permeance (WVP), ASTM E96:

1) Perm (inch-pound): 1.4 to 2.4.
2) Grams/Pa s m2 x 10 (-8): 8.1 to 13.6.
3) Nanograms/Pa s m2: 81.1 to 136.3.

d. Vapor Emission Testing, ASTM F 1869: Not more than 3 lbs.

e. Alkali Resistance, ASTM D1308: 100% resistant to 30 day exposure to 14 pH and 35% potassium hydroxide resistant.
f. Alkalinity Control: Suppress 14 pH without damage per ASTM F710.
g. Concrete Adhesion: 100% concrete cohesive failure in accordance with ASTM FD4541 pull-off adhesion tester.

3. Physical Properties:

a. Product Type: Water based.
b. Product Color: White, dries clear.
c. Solids Content: 37 percent by volume.
d. Thickness: 4 to 6 mills, WFT.
e. Material Mixture: Two-component.
f. Number of Coats: Two coat application.
g. Spread Rate: 250 to 350 square feet per gallon per coat.
h. Flooring Ready: 7 days.
i. Foot Traffic: 10 to 12 hours.
j. Product Odor: Slight odor.
k. Environmental: Non-corrosive, water based, water clean up product.
l. Product passes the California Department of Health Services Section 01650 Toxic VOC testing.
m. Product shall mix easily with concrete cement paste.
n. Product is not classified as a marine pollutant.
o. Product shall not contain hazardous air pollutants.
p. Volatile Organic Compounds (VOC) Content: 35 g/liter per EPA Method 24.

2.3 TOPICAL CONCRETE VAPOR CONTROL BARRIERS FOR EXISTING CONCRETE

A. Description: Liquid applied, two-component epoxy based product for application to properly prepared existing concrete slabs on grade and designed to suppress water vapor emission, alkalinity, and relative humidity rates from concrete. Material shall be a polymer (non-silicate) based penetrating, film forming barrier that remains compatible with flooring adhesives.

1. Basis of Design: Drawings and specifications are based on the following:

a. Synthetics International; Synthetic 30.

1) Subject to compliance with requirements, provide the product indicated or an equivalent product by one of the following:

a) Diamond Stone Products.
b) Ardex Moisture Control.

2. Performance Requirements: Applied product systems shall meet performance requirements indicated without failure due to defective manufacture or installation.

a. Relative Humidity: Suppress 100 percent relative humidity in accordance with ASTM F2170.

b. Water Vapor Transmission Rate (WRT), ASTM E96:

1) Grains/sf/hour: 0.60 to 1.0 or less.
2) Pounds/1,000 sf/24 hours: 2.0 to 3.3 or less.
3) Grams/hour per square meter: 0.40 to 0.70 or less.

c. Water Vapor Permeance (WVP), ASTM E96:

1) Perm (inch-pound): 1.4 to 2.4.
2) Grams/Pa s m2 x 10 (-8): 8.1 to 13.6.
3) Nanograms/Pa s m2: 81.1 to 136.3.

d. Vapor Emission Testing, ASTM F 1869: Not more than 3 lbs.
e. Alkali Resistance, ASTM D1308: 100% resistant to 30 day exposure to 14 pH and 35% potassium hydroxide resistant.
f. Alkalinity Control: Suppress 14 pH without damage per ASTM F710.
g. Concrete Adhesion: 100% concrete cohesive failure in accordance with ASTM FD4541 pull-off adhesion tester.

3. Physical Properties:

a. Product Type: Water based epoxy.
b. Product Color: Clear or white.
c. Solids Content: 40 to 50 percent by volume.
d. Thickness: 6 - 10 mills, DFT.
e. Material Mixture: Two-component.
f. Number of Coats: Two coat application.
g. Spread Rate: 250 square feet per gallon per coat.
h. Flooring Ready: 24 to 48 hours.
i. Foot Traffic: 10 to 12 hours.
j. Product Odor: Slight odor.
k. Environmental: Non-corrosive, water based, water clean up product.
l. Product passes the California Department of Health Services Section 01650 Toxic VOC testing.
m. Product is non-corrosive, non-combustible, non-flammable, and non-hazardous to installers.
n. Product is not classified as a marine pollutant.
o. Volatile Organic Compounds (VOC) Content: 35 to 65 g/liter per EPA Method 24.

4. Product shall be primed and coated with a 1/8 inch thick cementitious topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review approved concrete mix design and examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

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

3.2 COORDINATION

A. Coordinate slab finish of new concrete slabs with Division 03 Section “Cast-in-Place Concrete.” New concrete slabs are to be finished with a light broom finish or prepared in accordance with requirements for existing concrete slabs.

3.3 APPLICATION, GENERAL

A. Manufacturer's Field Service Representative: Engage a factory-authorized service representative to inspect the substrate before application of surface treatment, to instruct Applicator on the product and application method to be used, and to supervise the product application.

B. Areas of Application: Apply topical concrete vapor control barrier to surfaces of concrete slabs-on-grade that are scheduled to receive adhered flooring products.

3.4 APPLICATION TO FRESH CONCRETE

A. Topical concrete vapor control barrier shall be applied in replacement of standard curing, sealing and hardening compounds.

B. Mix and apply product in accordance with manufacturer’s written installation instructions.

C. Apply topical concrete vapor control barrier to concrete surfaces when final power troweling of concrete is to begin. Apply by electric sprayer and provide even coverage over entire substrate.

1. Apply 1 coat at a spread rate of 250 to 350 sf/gallon for each coat.
2. Where concrete slab areas are inaccessible to power trowel equipment, apply one coat at the beginning of hand troweling operations.

D. Protect from walking traffic for 12 hours and heavy traffic for 36 hours.

3.5 APPLICATION TO EXISTING CONCRETE

A. Preparation of Existing Concrete Slabs: Before application of surface treatment, clean substrate of substances that could impair penetration or performance of product according to manufacturer's written instructions and as follows:

1. Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents.
2. Use a high volume blower to remove surface sand and dirt and/or rinse with clean water to remove debris. Proceed with application when concrete surface is clean and dry.
3. Surfaces shall be clean and free of mud, dirt and contamination for other trades.

4. Shot blast floors to an ICRI # 4 using #420 shot and grind near edges.

B. Mix and apply product in accordance with manufacturer's written installation instructions.

C. Crack and Joint Treatment: Seal all cracks and joints with product during initial application.

D. Apply topical concrete vapor control barrier by electric sprayer and/or roller, spread evenly over entire substrate, cracks, joints and penetrations by flat squeegee and back roll with lint free nap roller.

1. Apply two coats at a spread rate of 250 sf/gallon per coat.

E. Apply manufacturer's approved primer and a nominal 1/8 inch cementitious topcoat over all barrier surfaces.

1. Cementitious topcoat is required for warranty extension for future flooring updates by Owner.

F. Protect from walking traffic for 12 hours and heavy traffic for 36 hours.

3.6 FIELD QUALITY CONTROL

A. Building shall be acclimated to the working environment of the Owner for not less than 2 weeks prior to field quality control testing.

B. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and prepare test reports directly on control barriers surface.

C. Testing shall be as specified in Division 09 Section "Flooring Moisture and Alkalinity Testing." Testing shall be performed after curing of concrete and vapor control system, and shall include the following tests:

1. Moisture vapor emission, ASTM F 1869.
2. Relative Humidity, ASTM F 2170.
3. Alkalinity-pH, ASTM F710.

D. Prior to testing, do not sand or grind concrete surfaces that have applied topical concrete vapor control barriers.

E. Test results shall be forwarded to the manufacturer for warranty registration.

F. Treated areas having a vapor emissions rate exceeding flooring product requirements for moisture and pH-Alkalinity shall be resealed at no additional cost to the owner.

3.7 CLEANING, PROTECTION, AND REPAIR

A. Immediately clean product from adjoining surfaces and surfaces soiled or damaged by application as work progresses. Correct damage to work of other trades caused by application.

B. Comply with manufacturer's written cleaning instructions.

C. Do not allow foot or wheel traffic after application for time periods recommended in writing by manufacturer.

D. Repair areas damaged during construction to allow a curing time of approximately 5 days prior to installing floor coverings.

END OF SECTION

SECTION 034843
PRECAST CONCRETE ARCHITECTURAL TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes precast concrete architectural trim units.

B. Related Sections include the following:

1. Division 04 Section "Concrete Unit Masonry" (CMU) for concrete unit masonry.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include design mixes.

B. Shop Drawings: Detail fabrication and installation of precast concrete trim units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.

1.4 QUALITY ASSURANCE

A. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

B. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

PART 2 - PRODUCTS

2.1 PRECAST ARCHITECTURAL CONCRETE TRIM UNITS

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. Concrete Designs, Inc.
2. Clovis Stone.

B. Precast Architectural CMU Wall Caps: Provide precast concrete trim units of shapes, profiles, and sizes as indicated on the Drawings.

1. Surface Finish: Smooth and typically void free unless otherwise indicated.
2. Color: As selected by Architect from manufacturer’s full range.

2.2 REINFORCING

A. Reinforcing, General: Reinforcing as recommended by precast manufacturer for products required for project conditions.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

F. Fabricating Reinforcement: Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" or ACI SP-66 and the details shown on the Drawings.

2.3 CONCRETE MATERIALS AND MIXTURES

A. Cementitious Materials: Use cementitious materials of the same type, brand, and source, throughout Project:

B. Portland Cement: ASTM C 150, Type I, gray or white.

1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.

D. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Concrete Mixtures: Mixture as recommended by precast manufacturer for products required for project conditions.

1. Compressive Strength (28 Days): 3,500 psi minimum.

2.4 ACCESSORIES

A. Provide clips, hangers, insets, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.5 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.6 MOLDS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes. Accurately construct molds, mortar tight, of sufficient strength to withstand pressures

due to concrete-placement operations and temperature changes. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement by release agent.

1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.7 FABRICATION

A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and supporting structural frame or foundation conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.

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

3.2 INSTALLATION

A. Install precast units in accordance with manufacturer's written instructions and recommendations.

B. Install clips, hangers and other accessories required for installing precast units to supporting members and backup materials.

C. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

1. Install temporary plastic spacing shims or bearing pads as precast concrete units are being erected.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

D. Anchor architectural precast concrete units in final position by grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth,

level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.4 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete manufacturer's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 042200
CONCRETE UNIT MASONRY

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 unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Mortar and grout.
3. Reinforcing steel.
4. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Division 03 Section “Cast-in-Place Concrete” for footings for masonry walls.
2. Division 07 Section “Joint Sealants” for sealants for masonry wall control joints.
3. Division 09 Section “Graffiti-Resistant Coatings” for graffiti-resistant coatings applied to unit masonry assemblies.

1.3 SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Samples for Initial Selection: For the following:

1. Concrete masonry unit color, in the form of small-scale units.
2. Colored mortar.

D. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

   a. Include material test reports substantiating compliance with requirements.
   b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780 for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019 for grout mixes required to comply with compressive strength requirement.

F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, 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. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings 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.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.

1. Determine net-area compressive strength (f'm) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.4 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for curved walls, lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.
2. Density Classification: Medium weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

   a. 8 x 8 x 16 inch nominal, 7 5/8 x 7 5/8 x 15 5/8 inch actual.

4. Exposed Faces: Precision face.
5. Pattern: Center score both faces.
6. Color: Gray, as cast.

2.5 LINTELS

A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Masonry Cement: ASTM C 91.

E. Mortar Cement: ASTM C 1329.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Davis Colors; True Tone Mortar Colors.
b. Approved equivalent.

G. Colored Cement Product: Packaged blend made from portland cement and lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
2. Pigments shall not exceed 10 percent of portland cement by weight.
3. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
4. Products:

a. Colored Portland Cement-Lime Mix:

1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond.
4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
5) Or approved equal.

b. Colored Masonry Cement:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Essroc, Italcementi Group; Brixment-in-Color.
3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.

4) Lafarge North America Inc.; Florida Custom Color Masonry or Magnolia Masonry Cement.
5) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
6) National Cement Company, Inc.; Coosa Masonry Cement.
7) Or approved equal.

c. Colored Mortar Cement:

1) Lafarge North America Inc.; Magnolia Superbond Mortar Cement.
2) Or approved equal.

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 and as indicated on the Drawings.

2.8 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of shape and dimensions indicated.

B. Postinstalled Anchors: Provide anchors as indicated on Drawings.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide one of the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.
    d. Approved equivalent.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide Type S mortar unless another type is indicated or needed to provide required compressive strength of masonry. Refer Structural Drawings for additional requirements.

D. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry. Refer Structural Drawings for additional requirements.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

E. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
2. Mix to match Architect's sample.

F. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.

G. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143/C 143M or with slump as indicated on Drawings.

2.12 SOURCE QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. Concrete Masonry Unit Test: For each type of unit furnished, test per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

D. Any mortar joints that are cracked or not bonded with the face shells of the CMUs are to be removed and joints repointed prior to grout placement.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

1. Locate joints as indicated on Drawings.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.7 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. 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.

B. Masonry Construction: Comply with requirements in TMS 602/ACI 530.1/ASCE 6 and 2019 CBC Sections 2104A.1, 2104A.1.3, and 2104A.1.3.1.2.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 and 2019 CBC Section 2104A.1.3.1.2 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 48 inches.
3. High lift grouting shall only be allowed with prior written approval by the enforcing agency.

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the masonry construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
b. Provide access to the Work for the designated Testing and Inspection Agency.
c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.
d. Provide and maintain for the sole use of the Testing and Inspection Agency adequate facilities for safe storage and proper curing of test specimens on the project site.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspection Services:

1. Testing and inspections shall be performed by the designated Testing and Inspection Agency.

2. Testing and inspections shall be in accordance with the 2019 California Building Code, Section 1705A.4, TMS 402-13, ACI 530-13, ASCE 5-13 Table 3.1.2 (Level B), and DSA Testing and Inspections form DSA 103.
3. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
4. Place grout only after inspectors has verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
5. Place grout only after inspectors have verified proportions of site-prepared grout.

E. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

F. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

G. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

I. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

1. The cost of additional testing and inspection of replaced work will be paid for by the Owner with the amount being deducted from the Contract Amount by a Change Order.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. 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 nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.10 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site and recycle or legally dispose of off Owner’s property.

END OF SECTION

SECTION 051200
STRUCTURAL STEEL FRAMING

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. Structural steel.
2. Shrink resistant grout.

B. Related Sections:

1. Division 01 Section “Quality and Testing Requirements” for administrative and procedural requirements for quality assurance including independent testing requirements.
2. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
3. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.

1.3 REFERENCED CODES AND STANDARDS

A. Comply with applicable provisions of the following specifications and documents:

1. California Code of Regulations, Title 24, Part 2, California Building Code, 2019 Edition.
2. American Institute of Steel Construction (AISC) Publications:

    a. ANSI/AISC 303-16, Code of Standard Practice for Steel Buildings and Bridges.
    b. ANSI/AISC 341-16, Seismic Provisions for Structural Steel Buildings.
    c. ANSI/AISC 360-16, Specification for Structural Steel Buildings.
    d. Quality Criteria and Inspection Standards, latest Edition.
    e. Manual of Steel Construction, 15th Edition.

3. American Welding Society (AWS):

    a. D1.1-15 Structural Welding Code - Steel.
    b. D1.8-16 Structural Welding Code – Seismic Supplement.

4. Steel Structures Painting Council (SSPC):

   a. Steel Structures Painting Manual, Vol. 2, Systems and Specifications, latest edition.

5. Federal Specifications:

   a. FF-W-84A, Washers, Lock (Spring).

6. Research Council on Structural Connections (RCSC): Specification for Structural Joints Using High Strength Bolts.

   a. ASTM C 1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink Grouts).
   b. ASTM F3125/3125M, Standard Specification for High Strength Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

1.4 SUBMITTALS

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

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.

C. Qualification Data: For fabricator and installer.

D. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

F. Certified mill test reports for structural steel, including chemical and physical properties.

G. Source quality-control reports.

H. Affidavit signed by the fabricator stating the structural steel furnished meets the requirements of the grade specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who employs adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. The Fabricator shall have completed a project of similar size and scope, and shall have adequate facilities, personnel, and equipment to meet production and quality requirements to maintain proper job progress. Certification by the AISC Quality Certification Program will provide satisfactory evidence of compliance.

B. Installer Qualifications: A qualified installer who employs adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. Certification by the AISC Quality Certification Program will provide satisfactory evidence of compliance.

C. Contractor Qualifications: The Contractor shall have completed a project of similar scope and shall have adequate facilities, personnel, and equipment to meet production and quality requirements to maintain proper job progress. Certification by the AISC Quality Certification Program will provide satisfactory evidence of compliance.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel" and AWS D1.8/D1.8M, “Structural Welding Code – Seismic Supplement.”

E. Identification of Structural Steel: The fabricator shall maintain the identity of the material and shall maintain suitable procedures and records attesting that the specified grade has been furnished, in compliance with AISC 360 and 2019 CBC Section 2202A.1.

1.6 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 fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. 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.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992.

1. For shapes that are part of the lateral force resisting system with flange thickness exceeding 1-1/2 inches and other shapes with flange thickness exceeding 2 inches, conform to the Supplementary Requirements of ASTM A6.

a. S30, Charpy V-Notch Impact Test for structural shapes: Alternate core location. Test to minimum average value of toughness of 20 ft-lb at 70°F.

B. Plate, Bar, Channels, and Angles: ASTM A 36 (A572 when specified).

1. For plate 2 inches and thicker, conform to the Supplementary Requirements of ASTM A6.

a. S5, Charpy V-Notch Impact Test. Test to minimum average value of toughness of 20 ft-lb at 70°F.

C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Standard unless otherwise indicated on Drawings.
2. Finish: Black except where indicated to be galvanized.

E. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.

F. Steel Forgings: ASTM A668/A668M.

G. Welding Electrodes: Comply with AWS requirements, electrodes shall be compatible with the base material being welded. For welds designated as demand critical as part of the lateral force resisting system, filler metal shall have Charpy V-Notch rating per AISC 341. For filler metals used in combination with filler metals of different processes, provide certification of Charpy V-Notch compatibility per AISC 341 and AWS D1.8.

1. Shielded Metal Arc Welding: AWS A5.1, E70XX.
2. Submerged Arc Welding: AWS A5.17, E7X.
3. Self-Shielded flux core - NR 233.

H. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.

I. Steel Forgings: ASTM A668/A668M.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. General: Provide hot dip zinc coated fasteners for exterior locations.

B. Bolts and Nuts:

1. General Use: Regular hexagon head type, ASTM A307, Grade A.
2. High Strength: Where high strength bolting is noted on drawings, bolts and nuts shall conform to following:

a. Bolts: ASTM A325, Type 1 or 2.
b. Nuts: ASTM C563.

C. Anchor Rods, Anchor Bolts, and Nuts:

1. General Use: ASTM F1554, Grade 36 (36ksi).
2. High Strength: ASTM F1554, Grade 55 (55ksi) with Supplementary Requirement No. 1 or Grade 105 (105ksi) where specified.
3. Provide color coding per ASTM F1554 at each exposed end of anchor rods.

D. Washers: Washers shall be suitable for use intended and as follows:

1. Circular washers shall be flat and smooth and conform to the requirements of ANSI B18.22.1, Type A.
2. Washers for high strength bolts shall conform to ASTM F436.
3. Plate Washers shall conform to the requirements of ASTM A36
4. Beveled washers for American Standard beams and channels shall be square or rectangular, shall taper in thickness and shall be smooth.
5. Lock washers shall conform to FF-W-84.

E. Welded Studs, Connectors, and Anchors: ASTM A 108, Grades 1015 through 1020, AWS D1.1.

1. Threaded Studs: Nelson type CPL threaded studs.
2. Shear Connectors: Nelson type S3L shear connector studs.

3. Deformed bar anchors: Nelson D2L deformed bar anchors.
4. Concrete Anchors: Nelson H4L concrete anchors.

2.3 FORGED-STEEL STRUCTURAL HARDWARE

A. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, AISI C-1035.

B. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, AISI C-1030.

2.4 PRIMER

A. Steel Primer: Fabricator's standard lead and chromate free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer:

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: ASTM A780/A780M.

2.5 SHRINK RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time, and having the following characteristics:

1. Be capable of producing a flowable grouting material having no drying shrinkage or settlement at any age.
2. Compressive strength of grout (2 inch cubes) shall be not less than 5,000 psi at age seven days and 7,500 psi at age 28 days.

B. Dry Pack Grout: 2 parts sand to 1 part cement.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303 "Code of Standard Practice for Steel Buildings and Bridges," AISC 360 “Specification for Structural Steel Buildings,” and AISC 341 “Seismic Provisions for Structural Steel Buildings including Supplement No. 1.”

1. Camber structural-steel members where indicated.

a. Camber horizontal members in accordance with AISC 360 Spec. Section M2. Do not use purely mechanical means to reverse over cambered beams.

2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel 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.
2. Thermal cutting will be permitted only with the specific approval of the Architect.
3. Stresses shall not be transmitted through thermally cut surfaces unless such surfaces are cut by a mechanically guided torch.
4. The radius of re-entrant flame cut fillets shall be as large as possible, but never less than one-half inch.
5. All Thermal cutting shall be smooth and regular in contour per AWS.
6. The net area of thermally cut members shall be determined by deducting one-eighth inch from the cut edges not made by a mechanically guided torch.

C. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill or punch holes perpendicular to steel surfaces, do not thermally cut bolt holes or enlarge holes by burning.
2. Remove outside burrs resulting from drilling or reaming operations with a tool making a 1/16 inch radius.
3. Make bolt holes 1/16 inch oversize typical. Anchor bolt holes in column base plates shall be oversized per drawings.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Welded Construction:

1. The location and type of all welds shall be as shown on the drawings. No weld splices shall be made except as shown.
2. All welds shall be made by the electric shielded arc or the submerged-arc methods. The welding sequence and technique of welding shall be carefully controlled to minimize locked-up stresses and distortion.
3. Visible welded joints shall be considered "finished" welds and shall be carefully executed to preclude the necessity of grinding or otherwise finishing. However, when the appearance of the weld is unacceptable, in the opinion of the Architect, grinding shall be of the highest standard for both field and shop practice.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with the following:

1. Remove oil, grease, and similar contaminants in accordance with SSPC-SP-1.
2. Clean off heavy rust and loose mill scale in accordance with SSPC-SP-2.

G. Welded Threaded Studs, Shear Connectors, and Concrete Anchors: Prepare steel surfaces and automatically end weld studs and concrete anchors in accordance with AWS D1.1/D1.1M and the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plate. There should be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for studs up to 5/8 inch in diameter, and approximately 3/16" in length for studs over 5/8 inch diameter.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified. Each member of the bolting crew applying high strength bolts shall be assigned an identification mark or symbol which shall be applied to each joint worked.

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. In addition, comply with AWS D1.8/D1.8M for “High Seismic Applications” as defined in AISC 360 where applicable.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. Remove oil, grease, and similar contaminants in accordance with SSPC-SP-1.
2. Clean off heavy rust and loose mill scale in accordance with SSPC-SP-2 "Hand Tool Cleaning," or SSPC-SP-3 "Power Tool Cleaning."

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize structural steel framing members that are exposed to the exterior and not located within the exterior walls of the building envelope.

2.10 SOURCE QUALITY CONTROL

A. Waiver of Source Quality Control: Source quality control testing shall not be required when fabricator participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant.

B. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Provide testing and inspecting agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Testing and inspection agency shall be acceptable to the Architect and the Division of the State Architect.

C. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

D. Testing and Inspection Services: The following tests and inspections shall be performed by the designated laboratory.

1. Steel Testing: All steel used for structural purposes shall be identified as required by 2019 CBC Section 2202A.1. Manufacturer’s mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.
2. Inspection of Welding: Shop welding operations including the installation of automatic end-welded stud shear connectors shall be inspected by a certified

Welding Inspector meeting the requirements of AWS QC1. The Fabricator shall schedule their operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

a. The Welding Inspector shall make a systematic record of all welds; recording shall include the following:

    1) Names and identification marks of welders.
    2) List of defective welds.
    3) Manner of correction of defects.

b. The Welding Inspector shall check the material, equipment, procedure, welds, and the ability of each welder.
c. Acceptance criteria shall be based on statically loaded connections. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.
d. The welding inspector shall tag or stamp accepted weldments with the inspector's identification stamp.
e. A report stating that the welding they are required to inspect, is proper and has been done in conformity with approved drawings and specifications shall be furnished to the Architect.
f. Welding inspections, testing and frequency shall conform to AWS D1.1, AWS D1.8 and related AISC documents. The Welding Inspector shall use all means necessary to determine the quality of the welds. However, the following tests and inspections shall be performed as a minimum:

    1) Visual Inspection of Welding:

        a) Observe multi-pass and full penetration welds continuously (i.e. the welding inspector shall be present at all times).
        b) Observe single pass fillet welds periodically. The inspector shall check the qualifications of the welders at the start of the work and then make final inspection of all welds for compliance prior to completion of welding.
        c) After the welding is completed, Contractor shall hand or power nylon brush welds, and thoroughly clean them before inspection.
        d) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.
        e) Inspect the preparation of groove welds for adequate throat opening and for snug positioning of back-up bars.
        f) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.
        g) Verify the use of proper pre-heat and interpass temperatures.
        h) Observe the technique of each welder periodically with the use of a welding inspection shield.

2) Nondestructive Testing of Welding:

a) Welds shall be non-destructive tested by one of the following methods in accordance with AWS D1.1 and AWS D1.8 at testing agency's option or as required by AWS or AISC at the frequency noted below:

Test Method	Frequency
Liquid Dye Penetrant Testing ASTM E165	When requested by Architect.
Magnetic Particle Testing ASTM E709	10% of all fillet welds and 100% of all full penetration welds on members thinner than 5/16".
Ultrasonic Testing ASTM E164	100% of all full penetration welds on members thicker than 5/16"
Radiographic Testing ASTM E94	When requested by Architect or as substitute for magnetic particles testing or ultrasonic testing.

b) Reduced Frequency of Ultrasonic Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 40 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 feet in length, each 12 linear inch increment of welds, one inch or less in thickness, shall be considered one weld. For evaluating the reject rate of continuous welds greater than 1 inch thickness, each 6 linear inches shall be considered one weld.

c) Reduced Frequency of Magnetic Particle Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 10%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 20 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of

welds containing rejectable defects divided by the number of welds completed. This reduction is not permitted on welds in the K-area, at repair sites, weld tab and backing removal sites and access holes.

g. Correction of Defective Welds: Weld areas containing defects exceeding the standards of acceptance in AWS D1.1 and AWS D1.8 shall be corrected in accordance with AWS D1.1, Section 3.7 and AWS D1.8. Additional testing of the repaired areas shall be required.

3. Welded Threaded Studs, Concrete Anchors, and Shear Connector Studs: Test and inspect installation in accordance with AWS D1.1. Random sample and test from stock furnished to each project. Tests shall meet the requirements of ASTM A108.

   a. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   b. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

4. Testing High Strength Bolts, Nuts and Washers: Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

   a. Materials: If the manufacturer's certification is not available, sample and test bolts, nuts and washers in accordance with ASTM A325 or A490, shipping lot method.
   b. Installation:

      1) Inspect slip critical connections and connections subject to direct tension in accordance with RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts.
      2) Tests shall be performed by an approved testing laboratory specifically approved for that purpose.
      3) The inspector shall check the materials, equipment, details of construction and installation procedure.
      4) The inspector shall furnish the Architect with a report that the work has been completed in every material respect in compliance with the approved drawings and specifications.

5. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with 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 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.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Erect steel in accordance with the AISC Specification Section M4 and AISC Code Section 7 Except as modified herein.

1. Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, report such condition immediately to the Architect and obtain approval for the methods of correction before proceeding with making any corrections.
2. Do not heat heat-treated parts for straightening.
3. Drain steelwork properly; fill pockets in structures exposed to the weather with an approved waterproof material.
4. When calibrated wrenches are used for tightening bolts, calibrate them at least once each working day using not less than three typical bolts of each diameter.

C. All structural steel framing shall be erected by experienced riggers and shall be carefully planned and laid out so that minimum cutting will be required. The work shall be erected plumb, square, and true to a line and level and in precise position as indicated. Temporary bracing, shoring and guys shall be introduced wherever necessary to provide for loads and stresses to which the structure may be subjected. Temporary bracing shall be left in place as long as may be required for safeguarding all parts of the work. As the erection progresses, the work shall be securely bolted up or welded, as required by the drawings to take care of all dead load, lateral forces and erection stresses.

D. Provide anchor bolts and other connections required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for setting bolts to accurate locations. Tighten anchor bolts after supporting members have been positioned and plumbed. Do not use impact torque wrenches to tighten anchor bolts set in concrete or masonry.

E. Base Bearing 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 to maintain plates in proper position while being grouted. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
2. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure prior to imposing dead or live loading on columns. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of weld made, and methods in correcting welding work. Visible welded joints shall be considered "finished" welds and shall be carefully executed to preclude the necessity of grinding or otherwise finishing. However, when the appearance of the weld is unacceptable, in the opinion of the Architect, grinding shall be of the highest standard for both field and shop practice.

G. Connections: Design connections for which details are not indicated in accordance with AISC "Manual of Steel Construction" for the full allowable shear capacity of the member.

H. Temporary welds, run-off plates, and backing strips shall be removed where exposed in the final structure.

I. Remove erection bolts on exposed, welded construction, fill holes with plug welds and grind smooth.

J. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

K. 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 will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

L. Splice members only where indicated.

M. Do not use thermal cutting during erection.

N. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

O. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

   a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
   b. Provide access to the Work for the designated Testing and Inspection Agency.
   c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.
   d. Provide and maintain for the sole use of the Testing and Inspection Agency adequate facilities for safe storage test specimens on the project site.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspection Services:

1. Testing and inspections shall be performed by the designated Testing and Inspection Agency.
2. Testing and inspections shall be in accordance with the 2019 California Building Code, Section 1705A.2 and Table 1705A.2.1, DSA Testing and Inspections form DSA 103, and Structural Drawings Special Inspection Criteria.
3. Steel Testing: All steel used for structural purposes shall be identified as required by 2019 CBC Section 2202A.1. Manufacturer’s mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require

additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.

a. Fabrication shall not commence until steel members designated on the Structural Testing and Inspection Schedule have been tested. Tests shall be made by an independent testing laboratory approved by the Architect. Reports certifying that the materials and workmanship conform to the contract documents shall be submitted to the Architect and the Division of the State Architect.

4. Inspection of Field Erection:

a. Verify qualifications of field procedures and personnel.
b. Inspect erection of structural steel work for conformance with the drawings and specifications.

5. Inspection of Welding: Field welding operations including the installation of automatic end-welded stud shear connectors shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1. The Contractor shall schedule their operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

a. The Welding Inspector shall make a systematic record of all welds; recording shall include the following:

1) Names and identification marks of welders.
2) List of defective welds.
3) Manner of correction of defects.

b. The Welding Inspector shall check the material, equipment, procedure, welds, and the ability of each welder.
c. Acceptance criteria shall be based on statically loaded connections. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.
d. The welding inspector shall tag or stamp accepted weldments with the inspector's identification stamp.
e. A report stating that the welding required to be inspected is proper and has been done in conformity with approved drawings and specifications shall be furnished to the Architect.
f. Welding inspections, testing, and frequency shall conform to AWS D1.1, AWS D1.8, and related AISC documents. The Welding Inspector shall use all means necessary to determine the quality of the welds. However, the following tests and inspections shall be performed as a minimum:

1) Visual Inspection of Welding:

a) Observe multi-pass and full penetration welds continuously (i.e. the welding inspector shall be present at all times).

b) Observe single pass fillet welds periodically. The inspector shall check the qualifications of the welders at the start of the work and then make final inspection of all welds for compliance prior to completion of welding.

c) After the welding is completed, Contractor shall hand or power nylon brush welds, and thoroughly clean them before inspection.

d) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.

e) Inspect the preparation of groove welds for adequate throat opening and for snug positioning of back-up bars.

f) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.

g) Verify the use of proper pre-heat and interpass temperatures.

h) Observe the technique of each welder periodically with the use of a welding inspection shield.

2) Nondestructive Testing of Welding:

a) Welds shall be non-destructive tested by one of the following methods in accordance with AWS D1.1 and AWS D1.8 at the frequency noted below:

Test Method	Frequency
Liquid Dye Penetrant Testing	When requested by Architect.
Magnetic Particle Testing	10% of all fillet welds and 100% of all full penetration welds on members thinner than 5/16".
Ultrasonic Testing	100% of all full penetration welds on members thicker than 5/16"
Radiographic Testing	When requested by Architect or as substitute for magnetic particles testing or ultrasonic testing.

b) Reduced Frequency of Ultrasonic Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be

calculated for each welder independently. A sample of at least 40 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 feet in length, each 12 linear inch increment of welds, one inch or less in thickness, shall be considered one weld. For evaluating the reject rate of continuous welds greater than 1 inch thickness, each 6 linear inches shall be considered one weld.

c) Reduced Frequency of Magnetic Particle Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 10%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 20 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. This reduction is not permitted on welds in the K-area, at repair sites, weld tab and backing removal sites and access holes.

g. Correction of Defective Welds: Weld areas containing defects exceeding the standards of acceptance in AWS D1.1 and AWS D1.8 shall be corrected in accordance with AWS D1.1, Section 3.7 and AWS D1.8. Additional testing of the repaired areas shall be required.

6. Welded Threaded Studs, Concrete Anchors, and Shear Connector Studs: Test installation in accordance with AWS D1.1. Random sample and test from stock furnished to each project. Tests shall meet the requirements of ASTM A108.

a. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
b. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

7. Testing High Strength Bolts, Nuts and Washers:

a. Materials: If the manufacturer's certification is not available, sample and test bolts, nuts and washers in accordance with ASTM A325 or A490, shipping lot method.
b. Installation:

1) Inspect slip critical connections and connections subject to direct tension in accordance with RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts.

2) Tests shall be performed by an approved testing laboratory specifically approved for that purpose.
3) The inspector shall check the materials, equipment, details of construction and installation procedure.
4) The inspector shall furnish the Architect with a report that the work has been completed in every material respect in compliance with the approved drawings and specifications.

8. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

   a. The cost of additional testing and inspection of replaced work will be paid for by the Owner with the amount being deducted from the Contract Amount by a Change Order.

3.5 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 053100
STEEL DECKING

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 roof deck.

B. Related Sections include the following:

1. Division 05 Section "Structural Steel Framing" for shop and field-welded shear connectors.
2. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 REFERENCED CODES AND STANDARDS

A. Comply with applicable provisions of the following codes and standards as adopted by the governing agency having jurisdiction over the project.

1. California Code of Regulations, Title 24, Part 2, California Building Code, 2019 Edition.
2. American Iron and Steel Institute (AISI): Specification for the Design of Cold-Formed Steel Structural Members.
3. American Society for Testing and Materials (ASTM) Publications:

   a. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
   b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
   c. C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

4. American Welding Society (AWS) Publications:

   a. D1.1 Structural Welding Code, Steel.
   b. D1.3 Structural Welding Code, Sheet Steel.

5. Steel Deck Institute (SDI) Publication:

   a. SDI 31: Design Manual for Composite Decks, Form Decks and Roof Decks.
   b. DDM03: Diaphragm Design Manual, Third Edition.

1.4 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Mill Tests: All material shall be accompanied by laboratory test reports. When such reports are not available, tests shall be performed by an independent laboratory acceptable to the Architect.

F. Research/Evaluation Reports: For the following from ICC-ES:

   1. Steel deck.
   2. Power-actuated mechanical fasteners.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm using adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIRMENTS

A. 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."

B. Vertical Design Criteria:

1. Loads as indicated on Drawings.
2. Construction loads shall be assumed to apply to the non-composite deck.
3. Maximum deflection of composite floor deck:

a. Under Live Load: Clear span (inches)/360.
b. Under Total Load: Clear span (inches)/240.

2.2 STEEL ROOF DECKING

A. Basis of Design: Design, Drawings, and Specifications are based on manufacturer and product(s) indicated on the Structural Drawings.

1. Provide product(s) indicated or submit a request for substitution per Division 01 “Section Substitution Procedures.”

a. Products not included in the approved Drawings and Specifications will require a DSA Construction Change Document to be reviewed and approved by DSA, refer to Division 01 Section “Contract Modification Procedures.” Expenses for Architectural and Engineering services, including DSA services, as a result of processing construction change documents will be deducted from the contract amount by a change order.

B. Steel Roof Decking: 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, Structural Steel (SS), Grade 40, with G60 zinc coating.
2. Deck Profile: As indicated on Drawings.
3. Profile Depth: As indicated on Drawings.
4. Design Uncoated-Steel Thickness: As indicated on Drawings.
5. Side Laps: Form side laps with interlocking edges to permit seam welding and/or button punch connection.
6. Span Condition: Double span or as indicated on Drawings.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch (20 gage) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick (14 gage), of same material and finish as deck. For drains, cut holes in the field.

J. Welding Electrodes: E60XX.

K. Galvanizing Repair Paint: ASTM A 780.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

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.

1. Verify that surfaces to receive decking are free from debris.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

1. Do not use unanchored deck units as a work or storage platform.
2. Permanently anchor all units placed by the end of each working day.
3. Keep material dry before, during and after installation.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and with not less than 2 inches of bearing on supporting framing before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Place units end to end before permanently fastening.
2. Align ribs over the entire length of run.
3. Place deck panels flat and square and fasten to supporting framing without warp or deflection.

E. Openings: Reinforce and frame openings through floor as necessary for rigidity and load-carrying capacity. Holes or other openings required for the work of other trades shall be drilled or cut and adequately reinforced by the respective trade; such holes or other openings larger than 6 inches in diameter shall be reviewed by the Architect.

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. Tolerance: Inspect the decking top surface for flatness after installation. The top flanges of each panel must be flat with no concavity or convexity which exceeds 1/16-inch. A straight edge placed across any three contact surfaces shall not leave a gap of more than 1/16 inch between the straight edge and any point of the contact surface, corrective measures or replacement shall be provided. Reinspect the decking after corrective measures or replacement has been performed.

I. Perform all welding in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturers of the base metal alloys being used. Location, size and spacing of welds shall be designed to withstand the loads specified herein and in accordance with the Steel Deck Institute recommendations and as shown on the shop drawings.

1. Clean welds immediately by chipping and wire brushing.
2. Heavily coat welds, cut edges, and damaged portions of galvanized finishes with galvanized repair paint.

J. Hammering which will injure or distort panels or framing will not be permitted or acceptable.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members as indicated on Drawings.

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 and end joints as indicated on Drawings.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck at spacings of not more than 12 inches apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports as indicated on Drawings.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. 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.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing agency will report inspection results promptly and in writing to the Division of the State Architect, Architect and Contractor.
2. Additional inspecting will be performed to determine compliance of corrected work with specified requirements. Expense for additional inspecting will be deducted from the Contract amount.

B. Contractor Duties and Responsibilities: It shall be the responsibility of the Contractor to maintain control of the quality of materials and workmanship and to obtain conformance with the drawings and specifications. To facilitate testing and inspection, the contractor shall:

1. Furnish all necessary materials and labor to assist the designated testing agency in obtaining and handling samples at the project or other sources of materials.
2. Advise the designated testing agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.
3. The Contractor shall correct deficiencies in the work which inspections and laboratory test reports indicate the Work to not be in compliance with requirements.

C. Testing and Inspection Services: The following testing and inspection services shall be performed by the designated laboratory and additional testing as may be necessary to reconfirm any non-compliance of original work to show compliance of corrected work.

1. Steel Testing: Mill analysis and test reports certified by the manufacturer may constitute sufficient evidence of conformity with the specifications provided the material can be identified in the fabricating shop in accordance with ASTM A6 by a representative of an independent testing laboratory approved by the Architect.

    a. When material cannot be identified or its source is questionable, one set of tension, elongation and bend tests shall be made for each 5 tons or fractional part thereof of each size. Provide product analysis to verify chemical composition.

2. Inspection of painting: Visual inspection touch-up painting.

3. Inspection of Welding: All field welding operations including the installation of automatic end-welded stud shear connectors shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1 and who has been approved by the Architect. The Contractor shall schedule his operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

    a. The Welding Inspector shall make a systematic record of all welds. This record shall include:

        1) Names and identification marks of welders.
        2) List of defective welds.
        3) Manner of correction of defects.

    b. The Welding Inspector shall check the material, equipment and procedure as well as the welds. He shall also check the ability of the welder.
    c. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.

d. The Welding Inspector shall use all means necessary to determine the quality of the welds. Inspection procedures shall conform to ASTM D1.3. The following visual inspection of welding shall be performed as a minimum:

1) Observe single pass fillet welds and arc spot welds periodically. The inspector shall check the qualifications of the welders at the start of the work and then make final inspection of all welds for compliance prior to completion of welding.
2) After the welding is completed, hand or power nylon brush welds, and thoroughly clean them before inspection.
3) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.
4) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.
5) Observe the technique of each welder periodically with the use of a welding inspection shield.

e. Welded Threaded Studs: Test installation in accordance with AWS D1.1. Random sample and test from stock furnished to each project. Tests shall meet the requirements of ASTM A108.

3.5 REPAIRS AND PROTECTION

A. Damaged materials which cannot be easily corrected without visible defects or weakening of members shall be discarded and replaced.

B. 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.

C. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

D. 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 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. Exterior wall and soffit framing.
2. Interior load-bearing and shear wall framing.
3. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
4. Floor/platform joist framing.

B. Related Sections include the following:

1. Division 03 Section “Post Installed Concrete Anchors” for post installed anchors in concrete and/or masonry.
2. Division 05 Section "Metal Fabrications" for miscellaneous framing with steel angles, channels, plates, and shapes.
3. Division 09 Section “Non-Structural Metal Framing” for standard, interior non-load-bearing, metal-stud framing within height limitations.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer’s written installation procedures and details.

1. Provide documentation that stud and track members are certified in accordance with the product certification program of the Steel Framing Industry Association (SFIA) or a similar organization that provides a verifiable code compliance program.

B. Evaluation Reports: From ICC-ES or IAPMO ES, or certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria, for the following:

1. Metal framing.
2. Post installed concrete anchors.
3. Powder-actuated fasteners.
4. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

C. Welding certificates (If products will be welded).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Use adequate number of skilled workmen who are thoroughly trained and experienced in the erection of cold formed steel framing and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 STANDARDS AND REFERENCES

A. California Code of Regulations, Title 24, Part 2, California Building Code, 2019 Edition.

B. American Iron and Steel Institute (AISI) Specifications and Standards. Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Standard for Cold-formed Steel Framing – Header Design.
2. Standard for Cold-formed Steel Framing – Lateral Design.
3. Standard for Cold-formed Steel Framing – Wall Stud Design.

C. ASTM International (ASTM):

1. ASTM A 653, Steel Sheet, Zinc Coated (galvanized) or zinc-iron alloy-coated by the Hot Dip Process, Physical (Structural) Quality.
2. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
3. C955 - Standard 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.
4. A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
5. ASTM A 1008, Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low Alloy with improved formability.
6. ASTM A 1011, Sheet & Strip, Hot-Rolled, Carbon, Structural, High Strength, Low Alloy with improved formability.
7. ASTM C 645, Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
8. ASTM C 754, Installation of Steel Framing Members to Receive Screw Attached Gypsum Board.

9. ASTM C 1007, Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
10. C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

D. Federal Specifications:

1. FF-P-395, Pin, Drive, Guided and Pin Drive, Power Actuated (Fasteners for Power Actuated and Hand Actuated Fastening Tools.
2. FF-S-325, Shield, Expansion: Nail, Expansion: and Nail, Drive Screw (Devices, Anchoring Masonry).

E. American Welding Society (AWS) Publication:

1. D1.1, Structural Welding Code, Steel.
2. D1.3, Structural Welding Code, Sheet Steel.

F. Metal Lath/Steel Framing Association (ML/SFA) Publication:

1. ML/SFA 540, Lightweight Steel Framing Systems.
2. ML/SFA 541, Selection Guidelines: Lightweight Steel Framing.
3. ML/SFA 920, Guide Specifications for Metal Lathing and Furring.

G. Steel Stud Manufacturers Association (SSMA):

1. Product Technical Information, ICC ESR-3064P.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling. Cover stored metal framing with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. California Expanded Metal Products Company (CEMCO).
2. ClarkDietrich.
3. MarinoWare; a Division of Ware Industries.
4. SCAFCO Corp.

2.2 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, comply with AISI S100, AISI S240, AISI S400.

B. Fire-Resistance Ratings: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.3 COLD FORMED METAL FRAMING MEMBERS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Identification of Metal Framing Members: Load bearing cold formed steel framing members shall be identified as required by 2019 CBC Section CBC 2202A.

C. Framing Members General: Comply with AISI S200, AISI S240, and ASTM C 955, Section 8 for conditions indicated.

D. Steel Sheet for Framing Members: ASTM A 1003/A 1003M, Structural Grade, Type H, or ASTM A653/A653M, metallic coated, of grade and coating weight as follows:

1. Grade:

   a. ST33H, 33 KSI for members 18 gauge (0.043 inch) and lighter in thickness.
   b. ST50H, 50 KSI for members 16 gauge (0.054 inch) and heavier in thickness.

2. Coating: G60 or equivalent.

E. Steel Sheet for Vertical Deflection and/or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50, Class 1 or 2.
2. Coating: G90.

F. Framing Members, General: Comply with ASTM C 955 for conditions indicated.

G. Steel Studs and Joists: Manufacturer's standard C-shaped steel studs and joists of web depths indicated, stiffened flanges, and as follows:

1. Studs: Punched openings regularly spaced along webs.
2. Joists: Un-punched webs.
3. Minimum Base-Metal Thickness: As indicated on Drawings.
4. Flange Width: As indicated on Drawings, 1-5/8 inches minimum.
5. Section Properties: As indicated on Drawings.

H. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches unless otherwise indicated.

I. Steel Headers: Manufacturer's standard C-shapes or L-shapes, matching studs, used to form header beams, of web depths indicated, punched, with stiffened flanges, and as indicated on the Drawings.

J. Deflection Track: Single or double deflection track as indicated on Drawings.

1. Single Deflection Track: Manufacturer's deflection track as indicated on Drawings; single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, minimum base metal thickness matching studs.
2. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges, minimum base metal thickness matching studs. Outer track to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure

K. Vertical Deflection Clips: Manufacturer's standard bypass or head clips as indicated on Drawings, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

L. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: Conform to ASTM A307.

C. Post Installed Concrete Anchors: Fabricated from corrosion-resistant materials; manufacturer, size, and type as indicated on Drawings, and as specified in Division 03 Section “Post Installed Concrete Anchors.”

D. Power-Actuated Fasteners: Fastener of manufacturer, size, and type as indicated on Drawings and as follows:

1. Concrete Attachment: Hilti X-U (ICC ESR-2269) pins unless otherwise indicated on Drawings; 0.157 inch diameter steel pins with steel washers; embedment of steel pins into concrete shall not be less than 1-1/4 inch.
2. Steel Attachment: Hilti X-U 15 (ICC ESR-2269) unless otherwise indicated on Drawings; 0.145 inch diameter steel pins with steel washers; protrusion of steel pins through steel members shall not be less than 1/4 inch.

E. Screw Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: E60XX electrodes complying with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

B. Galvanizing Repair Paint: ASTM A 780.

C. Nonmetallic, Nonshrink Grout: Factory packaged, nonmetallic, noncorrosive, nonstaining grout complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil nominal thickness, self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil thick, polyethylene-film reinforcement, and with release liner on adhesive side; match width of bottom track.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and assemblies plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by not less than three exposed screw threads.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing 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.

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete construction.

B. Install sill sealer gasket in accordance with manufacturer's written instructions at the underside of wall bottom track and at the top of foundation wall or slab at stud locations.

3.3 INSTALLATION OF FRAMING, GENERAL

A. Install cold-formed metal framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Drawings and complying with requirements for spacing, edge distances, and screw penetration.

C. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation, specified in applicable Division 07 Section, in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings indicated on Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated on Drawings, spacing shall not to exceed 24 inches on center.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings as indicated on Drawings with not less than double studs at each side of jambs. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Isolate non-load-bearing steel wall framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install top of wall deflection tracks of type indicated on Drawings and anchor to building structure.
2. Connect vertical deflection clips to studs and anchor deflection clips to building structure as indicated on Drawings.
3. Connect drift clips to cold formed metal framing and anchor drift clips to building structure as indicated on Drawings.

J. Install horizontal bridging in stud system, spaced 48 inches on center maximum, fasten bridging to stud at each stud intersection. Install bridging as indicated on Drawings, or if not indicated, install one of the following:

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Bridging: Combination of flat, taut, steel sheet straps, 1-1/2 by 0.0329 inch, and stud-track solid blocking of matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Drawings.

B. Install joists bearing on supporting framing, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Drawings.

C. Space joists not more than 2 inches from abutting walls, and as indicated on Drawings.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Drawings.

F. Install bridging at intervals indicated on Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.
2. Testing and inspecting agency will report test results promptly and in writing to Architect, Division of the State Architect, and Contractor.
3. The cost of additional testing and inspecting of corrected, replaced and/or additional Work will be paid for by the Owner and the cost will be deducted from the contract sum by a change order.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Duties and Responsibilities:

1. Contractor shall maintain control of the quality of materials and workmanship to conform to the drawings and specifications.
2. Facilitate testing and inspection as follows:

a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
b. Provide access to the Work for the designated Testing and Inspection Agency.
c. Furnish all necessary materials and labor to assist the designated testing and inspecting agency in obtaining and handling samples at the project or other sources of materials.

3. Contractor shall correct deficiencies in the Work where tests and inspections indicate the Work does not comply with the Contract Documents.

D. Tests and Inspections:

1. The following testing and inspecting shall be performed by the designated Testing and Inspection agency.

a. Welding of Load Resisting Framing: Inspecting and testing of structural welding of load resisting framing members shall be as required by 2019 CBC Section 1705A.2.5 for projects under the jurisdiction of DSA.

1) Field and shop welds will be subject to testing and inspecting.

b. Wind force Resisting Framing: Inspecting and testing of wind force resisting framing shall be as required by 2019 CBC Section 1705A.11.2 for projects under the jurisdiction of DSA.

2. Steel Testing:

   a. Manufacturer's mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.
   b. Fabrication shall not commence until steel members designated on the Structural Testing and Inspection Schedule have been tested. Tests shall be made by an independent testing laboratory approved by the Architect. Reports certifying that the materials and workmanship conform to the contract documents shall be submitted to the Architect and the Division of the State Architect.

3. Shop Fabrication:

   a. Inspection of shop fabrication of all members shall be performed by an independent testing laboratory approved by the Architect.
   b. A report stating that all the materials and workmanship conform to approved drawings and specifications shall be submitted to the Architect.

4. Field Erection:

   a. Verify qualifications of field procedures and personnel.
   b. Inspect erection of cold formed steel work for conformance with the drawings and specifications.

5. Welding:

   a. All shop and field welding operations shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1 and who has been approved by the Architect. The Contractor shall schedule his operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.
   b. The Welding Inspector shall be an individual trained and thoroughly experienced in inspecting welding operations. The Welding Inspector's ability to distinguish between sound and unsound welding shall be reliably established.
   c. The Welding Inspector shall make a systematic record of all welds. This record shall include:

      1) Names and identification marks of welders.
      2) List of defective welds.
      3) Manner of correction of defects.

   d. The Welding Inspector shall check the material, equipment and procedure as well as the welds. He shall also check the ability of the welder.
   e. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.

f. The welding inspector shall tag or stamp accepted weldments with the inspector's identification stamp

g. A report stating that the welding he is required to inspect, is proper and has been done in conformity with approved drawings and specifications shall be furnished to the Architect.

h. The Welding Inspector shall use all means necessary to determine the quality of the welds. Inspection procedures shall conform to AWS D1.3. However, the following tests and inspections shall be performed as a minimum:

1) Visual Inspection of Welding:

a) Observe multi-pass and full penetration welds continuously (i.e. the welding inspector shall be present at all times).

b) Observe single pass fillet welds periodically. The inspector shall check the qualifications of the welders at the start of the work and then make final inspection of all welds for compliance prior to completion of welding.

c) After the welding is completed, hand or power nylon brush welds, and thoroughly clean them before inspection.

d) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.

e) Inspect the preparation of groove welds for adequate throat opening and for snug positioning of back-up bars.

f) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.

g) Verify the use of proper pre-heat and interpass temperatures.

h) Observe the technique of each welder periodically with the use of a welding inspection shield.

2) Nondestructive Testing of Welding:

a) Welds shall be non-destructive tested by one of the following methods in accordance with AWS D1.1 at the frequency noted below:

Test Method	Frequency
Liquid Dye Penetrant Testing	When requested by Architect.
Magnetic Particle Testing	10% of all fillet welds and 100% of all full penetration welds
Radiographic Testing	When requested by Architect or as substitute for magnetic particles testing or ultrasonic testing.

b) Reduced Frequency of Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 40 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 feet in length, each 12 linear inch increment of welds, one inch or less in thickness, shall be considered one weld. For evaluating the reject rate of continuous welds greater than 2 inch thickness, each 6 linear inches shall be considered one weld.

E. Remove and replace work where test results indicate that it does not comply with specified requirements.

F. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer ensuring cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 054600
COMPOSITE SHEAR PANELS

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. Composite gypsum board/steel sheet shear panels and fasteners.

B. Related Sections include the following:

1. Division 05 Section “Structural Steel Framing”.
2. Division 05 Section “Cold Formed Metal Framing”.
3. Division 06 Section “Exterior Gypsum Sheathing”.
4. Division 09 Section “Gypsum Board.”

1.3 SUBMITTALS

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

B. Shop drawings: Include panel layout and fastener size/type and spacing.

C. Research/Evaluation Reports: From ICC-ES or IAPMO ES, for composite shear panels.

1.4 REFERENCES

A. Codes and standards:

1. AISI, North American Specifications for the Design of Cold-Formed Steel Structural Members.
2. ASCE/SEI 7/20198 CBC.
3. ASTM, designations indicated.
4. IAPMO-ES Evaluation Report Number ER-0126 for Steel and Wood framing
5. ICC-ES Evaluation Report Number ER 5762 for steel framing.

B. Division of the State Architect, Interpretive Regulations:

1. DSA IR A-5, Acceptance of Products, Materials, & Evaluation Reports.

1.5 DELIVERY, STORAGE AND HANDLING

A. Package composite shear panels for protection during transportation and handling. Deliver panels so as not to be damaged or deformed.

B. Unload, store, and erect panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.6 COORDINATION

A. Coordinate composite shear panel installation with work of Division 05 Section “Cold Formed Metal Framing” for framing and blocking/backing at panel ends and edges.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.2 COMPOSITE SHEAR PANELS

A. General: Factory assembled composite shear panels fabricated from metal facing sheet and gypsum board panel securely bonded together during fabrication.

1. Panel Size: 48 inches by 8, 9, and 10 foot lengths.

B. Basis of Design: Design, Drawings, and Specifications are based on the following:

1. California Expanded Metals Co. (CEMCO); Sure-Board Series 200 Shear Panels (IAPMO ES ER-0126, ICC ES ER-5762).

a. Substitutions: No substitutions will be allowed; products are per structural engineering calculations and DSA approved Construction Documents.

C. Steel Sheet: Galvanized steel sheet, ASTM A 653, Commercial Steel (CS), Grade 33, minimum base metal thickness of 0.027 inch (22 gauge), minimum G40 hot dipped galvanized coating per ASTM A 924.

D. Gypsum Wallboard: ASTM C 1396/C 1396M, 5/8 inch thick, Type X, tapered edges, and as specified in Division 09 Section “Gypsum Board.”

E. Bonding Adhesive: Bonding adhesive as recommended by composite shear panel manufacturer for factory bonding gypsum board to steel sheet; adhesive shall contain no urea formaldehyde.

2.3 ACCESSORY MATERIALS

A. Fasteners: Self-drilling/self-tapping bugle head screws as recommended by panel manufacturer and as required by Research/Evaluation report.

B. Miscellaneous Metal Subframing: Metal framing as specified in Division 05 Section “Cold Formed Metal Framing.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, mold damaged, and/or physically damaged.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, backing, and other miscellaneous panel support members according to ASTM C 754, composite shear panel manufacturer's written recommendations, and as specified in Division 05 Section “Cold Formed Metal Framing.”

3.3 INSTALLATION OF COMPOSITE SHEAR PANELS

A. General: Install panels in accordance with panel manufacturer’s written installation instructions, ICC ES ESR and/or IAPMO reports, and as indicated on Drawings.

B. Cutting Panels:

1. General: Cut composite shear panels from the steel panel side using a ferrous metal cutting blade in a circular saw.
2. Full Length or Width Cutting: Set blade depth to maximum 1/8” depth and cut steel only, cutting steel sheet for required length or width. Score gypsum board with a razor knife, then bend over to score paper on face side; snap cut-off piece and clean up edge with rasp if necessary.

3. Partial Lengths or Widths, Outlets and Opening Cuts: Set blade depth to maximum 1/8" depth and cut steel only where necessary, minimal over cutting may be required to allow for routing gypsum at the corners; peel off steel in required areas, use router to cut off unwanted gypsum at opening or outlet.

C. Installing Panels:

1. Install panels horizontally or vertically as indicated on Drawings.
2. Install panels with gypsum board face side out and panel metal facing against metal framing. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
3. Locate edge and end joints over supports or backing; coordinate with work of Division 05 Section "Cold Formed Metal Framing."
4. Do not place tapered edges against cut edges or ends.
5. Fasten panels to metal framing with steel drill screws, space fasteners as indicated on Drawings.

   a. Fastener heads are to be installed flush to the gypsum panel face material, or just below the surface, at the field and perimeter edges; setback fasteners a minimum of 3/8" from all edges of the panel.

D. Fire Resistance Rated Assemblies: Install panels in accordance with referenced fire resistance rated design requirements indicated on Drawings.

3.4 GYPSUM BOARD PANEL REPAIR

A. Repairs of Damaged Gypsum Panels: Where gypsum panel become damaged during construction, weather conditions, etc., the repair of the damaged panels may be completed using the following method:

1. Identify portion(s) of the damaged gypsum panels to be replaced or repaired.
2. Score the gypsum panel with a drywall knife or router (set to depth of gypsum sheet), remove fasteners and damaged portion of the gypsum panel. Do not cut or damage the steel sheet.
3. Re-fasten the sheet steel using minimum No. 8 x 3/4 inch self-tapping pan-head screws into framing and/or backing, locate fasteners 1/2 inch minimum from original fastener locations, do not install new fasteners into existing holes. Do not exceed original fastener spacings indicated on Drawings.
4. Patch gypsum board and screw off only as necessary to accommodate the taping process. The gypsum patch need only be screwed to the sheet steel of the panel.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace gypsum board panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

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. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel weld plates and angles for casting into concrete not specified in other Sections.
4. Metal vehicle swing gates.
5. Pipe bollards.
6. Guards and hand railings.
7. Stainless steel counter tops.

B. Related Sections:

1. Division 03 Section “Post Installed Concrete Anchors” for post installed anchors in concrete and/or masonry.
2. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
3. Division 05 Section "Structural Steel Framing" for structural steel framing.
4. Division 05 Section "Decorative Formed Metal" for decorative stainless steel architectural elements.
5. Division 32 Section “Decorative Metal Fences and Gates” for metal fencing and pedestrian gates.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.

B. Shop Drawings: For metal fabrications, include plans, elevations, sections, and details of metal fabrications and their connections; show anchorage and accessory items. Show fabrication and installation details for metal fabrications.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research Reports: For post-installed anchors.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of in-place construction contiguous with metal fabrications 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 metal fabrications without field measurements. Coordinate contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

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

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg. F ambient; 180 deg F, material surfaces.

2.2 METAL PRODUCTS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

1. Provide galvanized finish for exterior installations where indicated.

E. Slotted Steel Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Basis of Design: Unistrut Corporation; P1000 Channel Framing System.
2. Size of Channels: 1-5/8 by 1-5/8 inches.
3. Channel Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.108-inch (12 gage) nominal thickness.
4. Material for Fittings: Steel conforming to ASTM A 575, A 576, A 36, or A635; with finish matching channels.

F. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

G. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

H. Iron Castings: Either gray or malleable iron, unless otherwise indicated.

I. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, structural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts and Unheaded Rods: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Post Installed Concrete Anchors: Fabricated from corrosion-resistant materials; manufacturer, size, and type as indicated on Drawings and specified in Division 03 Section “Post Installed Concrete Anchors.”

2.4 MISCELLANEOUS MATERIALS

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

B. Shop Primers: Provide primers that comply with Division 09 Section “Painting.”

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

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

E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

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

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

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

E. Weld connections, corners, and seams continuously, unless otherwise indicated, to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
5. Cope ends of pipe or round tubing at connections to provide close fit.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and connections that will be exposed to weather in a manner that excludes water. Provide weep holes for drainage where water may accumulate.

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

I. Provide for anchorage of type indicated on Drawings; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as indicated on the Drawings and as needed to complete the Work.

B. Fabricate miscellaneous framing and supports from steel shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by miscellaneous framing and supports.

1. Drill, cut, and tap miscellaneous framing and supports to field bolted connections and to receive hardware, hangers, and similar items.

C. Prime miscellaneous framing and supports used at interior applications.

D. Galvanize miscellaneous framing and supports used for exterior applications or where indicated.

2.7 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

2.9 METAL VEHICLE SWING GATES

A. General: Metal vehicle swing gates of material, size, and configuration as indicated on Drawings; fabricate gates from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges.

B. Hinges: Weldable steel, flat mount, 180 degree swing, flully lubricated and with grease fitting, galvanized finish, 3,000 lb capacity per pair.

1. Available Product: Guardian Gate Hardware; Gorilla King Hinge, distributed by All Gate Hardware.

C. Decorative Plate/Panels: Material, thickness, and pattern as indicated on Drawings.

D. Finish: Galvanize gate frames and panels after fabrication. Weld hinges to gate frames after galvanizing and repair finish with galvanizing repair paint.

2.10 METAL BOLLARDS

A. Fixed Bollards: Fabricate fixed metal bollards from Schedule 40 galvanized steel pipe.

1. Size: As indicated on Drawings, not less than 4 inches nominal diameter (4.5 inches actual outside diameter.

2.11 GUARDS

A. General: Provide guards as indicated on Drawings for protection of equipment and items projecting from walls. Fabricate guards to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

B. Guards:

1. Material: Schedule 40 steel pipe or round steel tubing of equivalent diameter and wall thickness of sizes indicated.
2. Diameter: As follows unless otherwise indicated on Drawings:

   a. Posts, and Top and Bottom Rails: 1-1/2 inch diameter schedule 40 pipe (1.9 inch outside diameter).
   b. Intermediate Rails: 1 inch diameter schedule 40 pipe (1.6 inch outside diameter).

3. Height: As indicated on drawings and as follows:

   a. 42 inches minimum measured vertically above the walking surface of ramps and/or walks, or the nosing of stair treads, to the top of guards.

      1) Height may be reduced to 36 inches measured vertically above the walking surface of ramps, walks, or the nosing of stair treads, to the top of guards, where the upper walking surface is not more than 30 inches above the lower adjacent ground surface.

4. Openings: Openings between intermediate rails or panels, and between posts and adjacent construction, shall be such that a 4 inch diameter sphere shall not pass through any opening where the upper walking surface is more than 30 inches above the lower adjacent ground surface.
5. Bottom Rails: Provide bottom rails matching post size and material with the centerline located 3 inches (2 inches minimum/4 inches maximum) above the walking surface where curbs are not provided below guards.
6. Finish:

   a. Interior Handrails: Prime paint.
   b. Exterior Handrails: Galvanize after fabrication.

C. Post Sleeves: Where posts are indicated to be installed in sleeves, provide sleeves as detailed on Drawings; fabricate sleeves from steel pipe or tubing of length indicated and having an inside diameter not less than 1/2 inch greater than the outside diameter of the post; cap bottom of sleeves with a steel plate.

D. Connections: Fabricate railings with welded connections unless otherwise indicated.

E. Changes in Direction: Form changes in direction by bending or by inserting prefabricated elbows.

1. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member

throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

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

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated; Close ends of returns.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. Provide crush-resistant fillers or other means to transfer loads through plaster or gypsum board wall finishes to structural supports to prevent bracket or fitting rotation and crushing of substrate.
2. Horizontal projections of handrail brackets shall provide 1-1/2 inch minimum clearance below the bottom of handrails (CBC 11B-505.6).
3. Handrail brackets shall provide 1-1/2 inch minimum clear between handrails and adjacent wall surfaces or other obstructions.

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

J. Expansion Control: Provide internal sleeves for continuous rails requiring provisions for expansion control.

2.12 STAINLESS STEEL COUNTER TOPS

A. Description: Stainless steel counter tops for overhead coiling door counters.

1. Material: Stainless steel, Type 304, 16 gauge thickness.
2. Edges: Straight edges, 1-1/2 inch vertical with 1/2 inch underside return.
3. Finish: Directional satin finish, ASTM A480/A480M, No. 4.

2.13 STEEL FINISHES

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

C. Galvanizing: Hot-dip galvanize exterior items and items indicated to be galvanized after fabrication to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. Shop Priming: Shop prime items not to be galvanized unless they are to remain unfinished or are embedded in concrete, or masonry, or unless otherwise indicated; shop prime galvanized items that are to receive field applied top coats.

1. Preparation of Surfaces:

a. Cleaning of Galvanized Items for Shop Priming: Where galvanized items are to receive field applied top coats, prepare for priming after galvanizing by thoroughly cleaning galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

b. Surface Preparation: Prepare surfaces to comply with the following:

1) Non-Galvanized Items:

a) Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

b) Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."

2) Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

2. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.14 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Directional Satin Finish: ASTM A480/ASTM A480M, No. 4.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing and conditions by other Specification Sections where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports as indicated on Drawings and to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor support framing securely to, and rigidly brace from, building structure.

3.4 INSTALLING METAL BOLLARDS

A. Fixed Bollards Anchored in Concrete: Anchor bollards in place with concrete footings as indicated on Drawings; center and align bollards in holes 3 inches above bottom of excavation; place concrete and vibrate or tamp for consolidation; contour top surface of concrete to slope/drain away from bollard; support and brace bollards in position until concrete has cured.

1. Fill bollards solidly with concrete, mounding top surface to shed water.

3.5 INSTALLING GUARDS

A. Railing and Post Connections, General: Use fully welded joints for permanently connecting components; comply with requirements for welded connections in Part 2 Articles "Fabrication, General" and “Railings and Guards” whether welding is performed in the shop or in the field.

1. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

B. Anchoring Posts in Concrete: Anchor posts as indicated on Drawings and as follows:

1. Sleeves: Clean holes of loose material, insert posts, and fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
2. Cored Holes in Concrete: Core-drill holes not less than 6 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
3. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

C. Attaching Railings to Walls: Locate brackets as indicated or, if not indicated, at spacing required to support structural loads; equally space brackets. Attach railings to walls with wall brackets as indicated on Drawings and as follows:

1. Crush Sleeves: Install crush sleeves between brackets and structural support where fastening brackets to walls through gypsum board, cement plaster, and similar finish materials.
2. Secure wall brackets as follows:

   a. Concrete and Masonry Walls: Use post installed concrete anchors.
   b. Metal Stud Framed Walls: Use self-tapping screws fastened to steel framing or to concealed steel reinforcements; coordinate backing with steel framed partition work.

3.6 INSTALLING STAINLESS STEEL COUNTER TOPS

A. General: Install stainless steel counter tops as indicated on Drawings.

3.7 REPAIRS

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

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

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

END OF SECTION

SECTION 055133
METAL LADDERS

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. Fixed aluminum interior roof access ladders.
2. Telescoping safety posts for ladders.

B. Related Sections include the following:

1. Division 07 Section "Roof Hatches" for roof access hatches.
2. Sections as applicable to project conditions for backing support for ladder anchorage concealed within other construction before ladder installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, and finishes.

B. Shop Drawings: Include plans, elevations, sections, and details of ladders and their connections. Show anchorage to adjoining Work.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal ladders 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 metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.5 COORDINATION

A. Coordinate installation of anchorages for metal ladders. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. OSHA Requirements: Comply with the following OSHA Requirements:

1. OSHA 1910.23, Ladders.
2. OSHA 1910.28, Duty to have fall protection and falling object protection.
3. OSHA 1910.29, Fall Protection Systems and falling object protection-criteria and practices.

B. ANSI: Comply with ANSI A14.3, Ladders - Fixed - Safety Requirements.

C. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500, cold-formed steel tubing.
3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

C. Nonferrous Metals:

1. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
3. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
4. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 ALUMINUM LADDERS

A. Interior Roof Access Ladder: Manufactured fixed aluminum access ladders complying with the following:

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

   a. O'Keeffe's Inc.; Model 500 Standard Duty Channel Rail Fixed Access Ladder.

      1) Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

         a) ACL Industries, Inc.
         b) Alco-Lite Industrial Products.
         c) Precision Ladders, LLC.

2. Siderails: Continuous extruded-aluminum channels or tubes, not less than 3 inches deep, 3/4 inch wide, and 1/8 inch thick.

   a. Space siderails 18 inches apart, unless otherwise indicated.
   b. Support each rail at top and bottom and not more than 60 inches on center with welded or bolted aluminum brackets.

      1) Brackets shall locate the ladder such that the centerline of rungs shall not be closer than 7 inches to the finished wall surface.
      2) Interior roof access ladders shall be floor and wall supported.
      3) Exterior roof to roof access ladders shall be wall supported only.

3. Rungs: Extruded-aluminum tubes, not less than 1 1/4 deep and not less than 1/8 inch thick, with ribbed tread surfaces, and capable of withstanding a 1,000 pound point load without deformation or failure.

   a. Fit rungs in centerline of siderails; fasten by stainless-steel fasteners, welding, or with brackets and aluminum rivets.
   b. Space rungs 12 inches on center alongside rails, 12 inches from top of roof access curb, and not more than 12 inches above the floor.

4. Finish: Mill finish.

2.4 LADDER SAFETY POST

A. Ladder-Assist Post: Ladder manufacturer's standard device for attachment to interior roof-access ladders.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: Post extends to not less than 42 inches above top rung.
3. Material: Steel tube.
4. Post: 1-5/8-inch diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat finish.
6. Location: Provide at each interior roof access ladder.

2.5 FASTENERS

A. Provide Type 304 stainless-steel fasteners for fastening aluminum ladders to in-place construction; select fasteners for type, grade, and class required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine wall framing for backing to verify actual locations before ladder installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install ladders level and plumb. Secure ladders in position with manufacturer's recommended anchoring devices.

B. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 057500
DECORATIVE FORMED STAINLESS STEEL PANELS

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. Decorative formed stainless steel panel architectural elements.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for metal fabrications other than decorative formed stainless-steel components.

1.3 SUBMITTALS

A. Product Data: For fasteners and accessory components.

B. Shop Drawings: For decorative formed stainless steel panels, include plans, elevations, sections, and details of stainless steel panels and their connections; show anchorage and accessory items. house items specified in other Sections.

1. Show dimensions of housed items specified in other Sections including locations of housing penetrations and attachments, and necessary clearances.

C. Samples for Verification: For each type of exposed finish required, prepared on 6-inch square Samples of metal of same thickness and material indicated for the Work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce required units.

C. Mockups: Construct initial and final mockups as follows:

1. Initial Mockup: Fabricate initial mockup to confirm general fabrication, panel profile, terminations, transitions, joints, electrical raceway routing, and fit and anchorage to adjoining wall and roof construction.

   a. Material: Fabricate initial mockup of 0.057-inch (16 gauge) cold rolled carbon steel.
   b. Fabricate the following:

      1) Panel, full size in width and not less than 3 feet in length.
      2) Panel joint of two panels not less than 12 inches in length.
      3) Top panel termination, full size, with transition to panel.

2. Final Mockup: Fabricate final mockup based on approved initial mockup to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for fabrication and installation, and to comply with additional requirements below.

   a. Material: Fabricate final mockup of 0.0625 inch (16 gauge) stainless steel sheet.
   b. Fabricate the following:

      1) Panel, full size in width and not less than 3 feet in length.
      2) Panel joint of two panels not less than 12 inches in length.
      3) Top panel termination, full size, with transition to panel. approved final top panel mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of in-place construction contiguous with metal fabrications 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 metal fabrications without field measurements. Coordinate contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate installation of decorative formed stainless steel with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

B. Coordinate decorative formed stainless steel work with lighting fixtures to be incorporated into decorative stainless steel panels.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg. F ambient; 180 deg F, material surfaces.

2.2 METAL PRODUCTS

A. Metal Surfaces, General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, structural steel, Grade 33, unless another grade is required by design loads.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners. Select fasteners for type, grade, and class required.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

C. Provide tamper-resistant flat-head screws for exposed fasteners unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Provide type and alloy of electrodes as recommended by producer of metal to be welded and as necessary for strength, corrosion resistance, and compatibility in fabricated items.

B. Sealants, Exterior: Elastomeric sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

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

2.5 FABRICATION

A. Form decorative stainless steel panels from 0.0625 inch (16 gauge) stainless steel sheet. Fabricate to fit tightly to adjoining construction.

1. Finish: No. 6 Dull satin finish.

B. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

D. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.

E. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

F. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.

G. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

H. Where welding is indicated, weld joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed. Use welding procedures that will blend with and not cause discoloration of metal being joined.

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

J. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

K. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

L. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

M. Fabricate seams and connections that will be exposed to weather in a manner that excludes water. Provide weep holes for drainage where water may accumulate.

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

O. Provide for anchorage of type indicated on Drawings; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 GENERAL FINISH REQUIREMENTS

A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

C. Stainless Steel Finish: No. 6 Dull satin finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.

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

3.2 INSTALLATION

A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.

1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

B. Use concealed anchorages where possible.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Install joint fillers, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.

E. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 CLEANING

A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths.

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

3.4 PROTECTION

A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 061053
MISCELLANEOUS ROUGH CARPENTRY

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. Solid sawn wood for blocking, backing, and nailers.
2. Engineered wood products for blocking, backing, and nailers.
3. Plywood backing panels for telecommunications equipment.

B. Related Sections:

1. Division 06 Section “Plywood Panel Floor Sheathing” for structural use panel floor sheathing.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

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. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Research/Evaluation Reports: From ICC-ES or IAPMO ES, for the following:

1. Wood-preservative-treated wood.

1.5 REFERENCED CODES AND STANDARDS

A. California Code of Regulations, Title 24, Part 2, California Building Code, 2019 Edition.

B. American Wood Council (AWC):

1. National Design Specification for Wood Construction with commentary, (ANSI/AWC NDS-2018).
2. Special Design Provisions for Wind and Seismic with commentary, (ANSI/AWC SDPWS-2015).

C. Lumber grading agencies and abbreviations:

1. NLGA: National Lumber Grades Authority.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stockpile materials sufficiently in advance of need to assure their availability in a timely manner for Work.

B. Use extreme care in off-loading of lumber to prevent damage, splitting, and breaking of materials.

C. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

D. Identify framing lumber by grade, and store each grade separately from other grades.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, unless otherwise indicated.

B. Moisture Content of Lumber: 19 percent maximum unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use Category UC2, for interior construction not in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 SAWN LUMBER

A. General: Solid sawn lumber for use as nailers or backing for anchorage of other items.

B. Dimension Lumber: Douglas Fir, WCLIB or WWPA, No. 2 or better, unless otherwise indicated on Drawings.

C. Timber: Douglas Fir, WCLIB or WWPA, No. 2 or better, unless otherwise indicated on Drawings.

2.4 ENGINEERED WOOD PRODUCTS

A. General: Solid engineered wood products for use as backing for attachment of other items.

B. Source Limitations: Obtain each type of engineered wood product from a single source from a single manufacturer.

C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

E. Rim Boards: Solid engineered wood product complying with APA PRR-401, rim board grade; factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

1. Material: product made from any combination solid lumber, wood strands, and veneers.
2. Thickness: 1-1/4 inches.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C ('A' face exposed to room), 3/4 inch nominal thickness.

1. Equipment backing panels to be finished with intumescent paint specified in Division 09 Section Painting or panels shall be of fire retardant treated plywood.

2.6 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber as indicated on Drawings, as required for project conditions, and as required for support or attachment of other construction, including but not limited to blocking, nailers, support curbs, and furring.

B. Dimension Lumber Items: Provide lumber of species and grade matching framing lumber.

1. For blocking not used for attachment of other construction, Utility or Stud grade lumber may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
2. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

C. Boards: Provide lumber of 19 percent maximum moisture content (S-DRY).

1. Exposed Boards: Where boards will not be concealed by other work or where painted finish is indicated, provide Select Merchantable Boards per WCLIP rules.
2. Concealed Boards: Where boards will be concealed by other work, provide any species graded construction boards or WCLIP No. 1 or better.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Fasteners in contact with preservative treated wood, including nuts and washers, shall be of hot dipped galvanized steel, stainless steel, or silicon bronze; the coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153. Fasteners other than nails, timber rivets, wood screws, and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum; comply with requirements of 2019 CBC 2304.10.5.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Post Installed Concrete Anchors: Fabricated from corrosion-resistant materials; manufacturer, size, and type as indicated on Drawings and specified in Division 03 Section “Post Installed Concrete Anchors.” Materials to comply with the following:

1. Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.8 METAL FRAMING ANCHORS AND HARDWARE

A. General: Connectors in contact with preservative treated or fire retardant treated wood shall be of hot dipped galvanized steel or stainless steel; the coating weights for zinc-coated connectors shall be in accordance with ASTM A 153; comply with requirements of 2019 CBC 2304.10.5.

B. Basis of Design Manufacturer: Provide products as indicated on Drawings manufactured by the following:

1. Simpson Strong-Tie Co., Inc.

C. Material: Galvanized steel sheet, hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

2.9 MISCELLANEOUS MATERIALS

A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. General: Install framing as indicated on drawings, as herein specified, and as required to comply with regulatory agencies and American Forest and Paper Association (AF&PA) document WCD 1 "Details for Conventional Wood Frame Construction". Notes and details on Drawings shall take precedence over these specifications.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood telecommunications backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Provide blocking and backing as indicated to support facing materials, fixtures, specialty items, and trim.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated on Drawings and complying with the following:

1. ICC ESR-1539 for power-driven staples and nails.
2. 2019 CBC Table 2304.10.1 “Fastening Schedule.”

I. Fasteners and connectors in contact with preservative treated or fire retardant treated wood shall be corrosion resistant as specified under Part 2 product requirements.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PROTECTION

A. Use all necessary means to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to, the approval of the Architect and at no additional cost to the Owner.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061600
PLYWOOD PANEL FLOOR SHEATHING

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. Fire retardant treated plywood panel floor sheathing.

B. Related Sections include the following:

1. Division 06 Section “Miscellaneous Rough Carpentry” for plywood telecommunications backing panels.
2. Division 06 Section "Interior Plywood Paneling" for exposed interior plywood paneling.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
2. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
3. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Evaluation Reports: For the following, from ICC-ES:

1. Fire-retardant-treated plywood.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Type: One of the following:

a. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
b. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood flooring unless otherwise indicated.

2.2 PLYWOOD PANEL FLOOR SHEATHING

A. Plywood Panel Floor Sheathing: Either DOC PS 1 or DOC PS 2, Exposure 1, structural sheathing unless otherwise indicated.

1. Span Rating: As indicated on Drawings.
2. Nominal Thickness: As indicated on Drawings, 3/4 inch minimum thickness.

3. Edge Detail: One of the following:

   a. Tongue and groove.
   b. Square edge with metal framing and /or backing at all panel edges.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

   1. Fasteners used for the attachment of fire retardant treated wood, including nuts and washers, shall be of hot dipped galvanized steel, stainless steel, or silicon bronze; the coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153. The coating weights for mechanically deposited zinc-coated steel fasteners shall be in accordance with ASTM B 695, Class 55 minimum. Comply with requirements of 2019 CBC 2304.10.1 and 2304.10.5.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 1513 and SAE J78, length as recommended by screw manufacturer for material being fastened, screws shall penetrate steel material greater than 33 mils by not less than 3 exposed threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

C. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

D. Fastening: Screw panels to cold formed metal framing as indicated on Drawings and in compliance with the following:

   1. 2019 California Building Code, Table 2304.10.1 “Fastening Schedule.”
   2. Make tight connections. Install fasteners without splitting wood.

END OF SECTION

SECTION 061643
EXTERIOR GYPSUM SHEATHING

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. Exterior glass mat gypsum wall sheathing.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for steel framing and supports.
2. Division 07 Section “Weather Resistive Barriers” for weather resistant barriers applied over sheathing.
3. Division 09 Section “Portland Cement Plaster” for exterior wall finish.
4. Division 09 Section “Gypsum Board” for interior gypsum board applications.

1.3 SUBMITTALS

A. Product Data: For sheathing, fasteners, and accessories.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and keep dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat with spacers between each bundle to provide air circulation and to prevent sagging. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 EXTERIOR GYPSUM SHEATHING

A. Source Limitations: Obtain each type of product through one source from a single manufacturer.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Basis of Design Product: G-P Gypsum Corporation; Dens-Glass Gold.

a. Subject to compliance with requirements, provide product indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”

2. Type and Thickness: Type X, 5/8 inch thick unless otherwise indicated.
3. Size: 48 by 96, 108 or 120 inches.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions with Installer present for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

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

3.2 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Coordinate installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

F. Weather Resistive Barrier: A weather resistive barrier is to be installed over wall sheathing; weather resistive barrier and installation is specified in Division 7 Section “Weather Resistive Barriers.”

3.3 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253, ASTM C 1280 and with manufacturer's written instructions.

B. Fasten gypsum sheathing to framing with screws. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.

D. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

E. Install panels horizontally or vertically, center vertical joints on studs, stagger end joints of adjacent boards of horizontal applications not less than one stud spacing, stagger end joints of adjacent boards of vertical applications not less than 2 feet. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches on center and set back a minimum of 3/8 inch from edges and ends of boards.

F. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes until work is concealed.

B. Remove and replace damaged panels.

END OF SECTION

SECTION 061663
CEMENT BOARD SHEATHING

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. Cement board panel wall sheathing for interior wall protection.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for steel framing and supports.
2. Division 06 Section “Interior Plywood Wall Paneling” for wood paneling.
3. Division 07 Section “Weather Resistive Barriers” for weather resistant barriers applied over sheathing.
4. Division 09 Section “Gypsum Board” for interior cement backer board for ceramic tile applications.

1.3 SUBMITTALS

A. Product Data: For sheathing, fasteners, and accessories.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and keep dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat with spacers between each bundle to provide air circulation and to prevent sagging. Protect panels from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 CEMENT BOARD SHEATHING

A. Cement Board Panels: Composite panels made with Portland cement reinforced with synthetic fibers and additives; noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.

1. Basis of Design Product: Finex; Finex Panels.

    a. Subject to compliance with requirements, provide product indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”
    b. Source Limitations: Obtain each type of product through one source from a single manufacturer.

2. Size: 48 by 96 inches.
3. Thickness: 1/4 inch.
4. Surface: Smooth and free of markings.
5. Edges: 1/8 inch beveled edge.

    a. Bevel edges in the field if factory bevel is not available.

6. Color: Gray (natural color).

2.2 FASTENERS

A. General: Provide stainless steel pancake head fasteners of size recommended by manufacturer.

1. Screws for Fastening cement board panels to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

    a. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
    b. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions with Installer present for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Cut panels at penetrations, edges, and other obstructions of work; provide 1/8 inch gap at abutting construction and penetrations, unless otherwise indicated.

D. Install panels in direction or pattern as indicated on Drawings.

E. Joints: Install panels with open joints as follows:

1. Vertical Joints: 1/8-inch.
2. Horizontal Joints: 1/4 inch.
3. Align joints with joints of adjacent plywood wall paneling.

F. Fastening: Fasten panels to framing with screws.

1. Predrill fastener holes 1/6 inch larger than the diameter of fasteners.
2. Space fasteners 16 inches nominal on center, horizontal and vertical, in a uniform pattern.
3. Fasteners shall penetrate steel framing or backing not less than 3/4 inch.
4. Locate fasteners 3/ 4 inch minimum from edges of panels. At corners, locate fasteners 2 inches from corners and 1 inch from edges.
5. Do not countersink fasteners.

END OF SECTION

SECTION 062013
EXTERIOR COMPOSITE WOOD

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. Section Includes:

1. Exterior composite wood members and trim.

1.3 SUBMITTALS

A. Product Data: For composite wood members, end caps, fasteners, and clips. Indicate component materials, dimensions, profiles, textures, and include construction and installation details.

B. Samples for Verification: For composite wood trim, minimum 5 inches by 5 inches.

C. Sample Warranties: For manufacturer's warranties.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling:

1. Store materials in accordance with manufacturer’s instructions.
2. Store members flat, off the ground, supported along their entire length, and covered.
3. Keep materials in manufacturer’s original, unopened containers and packaging until installation.
4. Store composite trim under cover, protected from weather, off ground, and on flat surface. Keep materials dry.
5. Protect materials during storage, handling, and installation to prevent damage.

1.5 WARRANTY

A. Manufacturer's Warranty for Composite Wood: Manufacturer agrees to repair or replace composite wood members that fails due to defects in manufacturing within specified warranty period. Failures include, but are not limited to, deterioration and/or fading or discoloration.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXTERIOR COMPOSITE WOOD

A. Exterior Composite Wood Members: Composite hollow wood members comprised of 60% sawdust and 40% recycled polyethylene with aluminum reinforcing tubes; products are non-toxic and 100% recyclable.

1. Basis-of-Design: Drawings and Specifications are based on the following:

a. Fiber Deck; WEO Brise-Soleil composite wood members.

1) Provide product specified or submit substitution request.

2. Product Characteristics:

a. Size: As indicated on Drawings from the following sizes:

1) Size: 42 x 60 mm (1 x 1.5 inches) with 20 x 30 x 2 mm aluminum reinforcing tube.
2) Size: 52 x 100 mm (1.3 x 2.5 inches) with 40 x 40 x 2 mm aluminum reinforcing tube.
3) Size: 62 x 100 mm (1.5 x 3.0 inches) with 50 x 50 x 2 mm aluminum reinforcing tube.

b. Length: 4 meters (13 feet, 1.5 inches)
c. Wall Thickness: 5 mm (1/8 inch).
d. Finish Surface: Wood grain texture.
e. Color: As selected by Architect from manufacturer’s full range.

2.2 ACCESSORIES

A. End Caps: Manufacturer’s end caps matching composite wood members.

B. Fasteners: Non-corrosive metal self-drilling screws or rivets as recommended by composite wood manufacturer.

C. Clips: Non-corrosive metal clips as recommend by composite wood manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, 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 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. Install composite wood members in accordance with manufacturer's instructions at locations indicated on the Drawings.

1. Install composite wood members with concealed fastening methods.

B. Cut composite trim in accordance with manufacturer's instructions.

C. Install end caps at exposed ends.

END OF SECTION

SECTION 064116
PLASTIC LAMINATE CASEWORK

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. Plastic-laminate faced architectural cabinets.
2. Plastic-laminate countertops.
3. Closet and utility shelving.

B. Related Sections:

1. Division 09 Section “Non-Structural Metal Framing” for backing required for installing cabinets and concealed within other construction before cabinet installation.

1.3 SUBMITTALS

A. Product Data: For each type of product, including cabinet hardware and accessories.

1. Provide documentation VOC content for adhesives.
2. Provide documentation that wood panel products and bonding adhesives contain no urea formaldehyde.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.
3. Apply WI-certified compliance label to first page of Shop Drawings.

C. Samples for Initial Selection: For items requiring color selection, submit the following:

1. Plastic laminates.
2. PVC edge material.

D. Samples for Verification:

1. 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.
2. Cabinet hardware, one unit for each type and finish of the following:

   a. Pulls.
   b. Hinges.
   c. Catches.
   d. Locks.
   e. Shelf supports.

E. Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project, who are familiar with Woodwork Institute fabrication requirements, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Installer shall be fabricator of plastic laminate casework or fabricator shall be responsible for the Work of the installer. Installers shall be skilled workers who are experienced installing products similar to those required for this Project, who are familiar with Woodwork Institute installation requirements, and have a record of successful in-service performance.

C. Woodwork Institute (WI) Quality Assurance Program: Plastic Laminate Casework shall be subject to the following WI quality assurance program:

1. Certified Compliance Program (CCP):

   a. A WI Certified Compliance Label shall be affixed to the first page of the original shop drawing set.
   b. A WI Certified Compliance Certificate shall be issued for plastic laminate cabinets, counter tops and installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver casework until painting and similar operations that could damage casework have been completed in installation areas. 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.

1.6 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. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements, Seismic Design: Comply with requirements of the California Building Code, Part 2, Volume 2, Chapter 16A (State Chapter) “Structural Design Requirements,” Sections 1613A.1 and 1617A, ASCE Section 7-16, Table 13.6-1, and WI construction methods for seismic design for schools and hospitals.

B. 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 2019 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 in counter tops and the fixtures are indicated to be accessible, counter top heights shall be verified and coordinated so that the top rim of sinks and lavatories 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 of counter tops.
   c. Depth of Knee and Toe Clearance: Measured from the front edge of counter tops.

      1) Depth at Floor Level: 19 inches minimum / 25 inches maximum; and not less than the reach depth over the counter top.
      2) Depth at +9 Inches: Depth at floor level less 6 inches maximum (13 inches minimum depth at +9 inches for a clear space depth of 19 inches at floor level; depth increases as depth at floor level increases).
      3) Depth at +27 Inches: Depth at floor level less 9 inches maximum (10 inches minimum depth at +27 inches for a clear space depth of 19 inches at floor level; depth increases as depth at floor level increases).

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 of counter tops.
   c. Depth of Knee and Toe Clearance: Measured from the front edge of counter tops.

      1) Depth at Floor Level: 17 inches minimum / 19 inches maximum; and not less than the reach depth over the counter top; actual depth may exceed 19 inches although it may not be considered as additional accessible toe space.
      2) Depth at +9 Inches: Depth at floor level less 6 inches maximum (11 inches minimum depth at +9 inches for a clear space depth of 17 inches at floor level; depth increases as depth at floor level increases).
      3) Depth at +27 Inches: Depth at floor level less 9 inches maximum (8 inches minimum depth at +27 inches for a clear space depth of 17 inches at floor level; depth increases as depth at floor level increases).

4. Side Reach Depth Over Counter Tops (Ref. CBC 11B-308.3.2): Where casework is to be accessible, casework shall be fabricated such that the side reach depth does not exceed 24 inches measured from the front edge of the counter top to the finished surface of the wall at the back of the counter top. Counter top heights shall not exceed 34 inches from the finished floor surface.

C. Quality Standard: Unless otherwise indicated, comply with Woodwork Institute's (WI) "North American Architectural Woodwork Standards" (NAAWS), latest edition, for grades of architectural plastic-laminate cabinets and counter tops indicated for construction, finishes, installation, and other requirements.

D. Seismic Design: Fabrication shall comply with referenced seismic design requirements.

2.2 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Unless otherwise indicated, comply with WI's "North American Architectural Woodwork Standards," latest edition, Section 10 "Casework" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Grade: Custom Grade except where Premium Grade requirements indicated.
2. Provide labels and certificates from the Woodwork Institute (WI) certification program indicating that woodwork, including installation, complies with requirements of grades specified.
3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard indicated.

B. Fabricate casework as multiple self-supporting units rigidly joined together or as single-length sections to fit access openings.

C. Type of Construction: Type A, Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Style 1, flush overlay.

E. Laminate Cladding for Exposed Exterior and Exposed Interior Surfaces: NEMA LD 3, High-pressure decorative laminate complying with the following requirements:

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).
4. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

F. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

   a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
   b. For semi-exposed backs of doors and other semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS and matching color of exposed surfaces.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC edge banding, 1/2 inch minimum thickness.
3. Drawer Bottoms: Thermoset decorative panels, 1/2 inch minimum thickness.

G. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL. Backs shall be 1/2 inch minimum thickness and mechanically fastened to cabinet bodies.

H. Security Dust Panels: Provide 3/4-inch thick security dust panels above lockable drawers, unless located directly under tops.

I. Shelves: Shelves shall be adjustable and supported by shelf standards and clips.

1. Design loading: 50 psf.
2. Maximum Width: 48 inches for concealed shelves, 42 inches for exposed shelves.
3. Thickness: 3/4 inch minimum.

a. Shelves over 30 inches in width shall be 1-inch minimum thickness.

J. Hinges: Doors 80 inches or more in height shall be provided with four (4) hinges.

K. Locks, Doors and Drawers: Provide locks where indicated on Drawings.

L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Wood grains, matte finish.
c. Patterns, matte finish.

2.3 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with WI's "North American Architectural Woodwork Standards," latest edition, Section 11 "Countertops" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Grade: Premium Grade.
2. Provide labels and certificates from the Woodwork Institute (WI) certification program indicating that woodwork, including installation, complies with requirements of grades specified.
3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard indicated.

B. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS or HGP as required for post-formed counter tops.

C. Colors and Pattern: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:

a. Solid colors, matte finish.

D. Edge Treatment: Same as laminate cladding on horizontal surfaces.

1. Splash: Integral cove splash with square top, 4 inches high unless otherwise indicated.
2. Front Edge: Full round edge unless otherwise indicated.

a. Square self-edge where full round edge cannot be used due to fabrication limitations.

E. Core Material: Particleboard, 3/4 inch thick; counter tops for sinks to be particleboard made with exterior glue.

F. 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 laminated to top.

G. Backer Sheet: Provide paper backing on underside of countertop substrate.

H. Cutouts: Edges of cut outs shall be sealed per WI Custom Grade requirements with a color toned water resistant varnish before sink or rims are installed.

2.4 CLOSET AND UTILITY SHELVING

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

B. Grade: Custom.

C. Shelf Material: 3/4-inch thermoset decorative panel with 0.12 inch (3 mm) PVC edge banding.

D. Cleats: 3/4-inch solid lumber.

2.5 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Panel Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated. Provide products containing no urea formaldehyde complying with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturer: 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; Div. of Premark International, Inc.

2. Plastic laminate colors and patterns shall not be allowed to be selected from manufacturer's discontinued stock.

2.6 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets and complying with ANSI/BHMA Grade 1 performance requirements.

B. Overlay Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch thick metal, with hospital tips; ANSI/BHMA 156.9, Grade 1.

1. Manufacturer/Product: Rockford Process Control (RCP) RP-376 or equivalent.

C. Wire Pulls: Back mounted, solid stainless steel or aluminum bent wire pulls, 4 inches long, 5/16 inch in diameter, 1-1/2 inch projection.

1. Manufacturer/Product: Doug Mockett and Company, Inc.; DP57B or equivalent.

D. Catches: Magnetic catches with aluminum body, 5 lb maximum pull load, ANSI/BHMA A156.9.

1. Manufacturer/Product: Ives, No. 325 or equivalent.

E. Drawer Slides: Ball bearing, full extension, side mounted; zinc-plated-steel ball-bearing slides ANSI/BHMA A156.9; Grade 1HD-100 and Grade 1HD-200.

1. Grade 1 HD-200, 200 lb capacity, for drawers more than 8 inches high or more than 24 inches wide.
2. Manufacturers: Accuride, Knape & Vogt, Grass, or equivalent.

F. Adjustable Shelf Standards and Supports: Steel standards and supports with zinc plated finish, ANSI/BHMA A156.9.

1. Manufacturer/Product: Knape & Vogt; No. 255 Supports with No. 256 clips.
2. Provide seismic restraint pins in back row or notch shelf.

G. Locks: Pin tumbler locks.

1. Cabinet Door Locks: ANSI/BHMA A156.11, E07121.
2. Cabinet Drawer Locks: ANSI/BHMA A156.11, E07041.
3. Manufacturer: CompX/National.
4. Keying: Confirm keying with Owner’s lock personnel.

H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

I. Grommets for Cable Passage through Countertops: Molded-plastic grommet with minimum 1-1/2-inch diameter cord opening with slotted cap, black.

1. Manufacturer/Product: Doug Mockett & Company, Inc.; "SG series."

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
2. Satin Stainless Steel: ANSI/BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.7 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Adhesives containing no urea formaldehyde and as recommended by fabricator or manufacturer. Use clear types where glue lines will be exposed.

D. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

2.8 FABRICATION

A. Interior Woodwork Grade: Comply with Woodwork Institute's (WI) "North American Architectural Woodwork Standards" (NAAWS), latest edition, quality standards indicated.

B. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

1. Accessible Casework: Comply with accessible regulatory requirements indicated in Part 2 Article "Performance Requirements."

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

E. Adjustable Shelf Standards: Adjustable shelf standards shall be recessed into cabinet sides.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.2 INSTALLATION OF CABINETS

A. Grade: Install cabinets to comply with same grade as item to be installed.

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. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3.3 INSTALLATION OF COUNTER TOPS

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. 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. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops 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.

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Where applied back splashes are used, secure backsplashes to tops with concealed metal brackets at 16 inches on center and to walls with adhesive.
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces.

END OF SECTION

SECTION 064216
INTERIOR PLYWOOD WALL PANELING

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. Interior plywood wall paneling.
2. Metal trim for plywood wall paneling.

B. Related Requirements:

1. Division 09 Section "Non-Structural Metal Framing" for backing required for support of paneling and which is concealed within other construction and installed prior to installation of paneling.
2. Division 09 Section “Painting” for field finishing of exposed paneling and trim.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Verification:

1. Wood panel product not less than 12 inches by 24 inches long for each species and cut (Samples to be finished by painting subcontractor).
2. Metal Trim: 12 inches long for each trim profile.

D. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be an entity employing skilled workers who are experienced installing products similar to those required for this Project, who are familiar with Woodwork Institute installation requirements, and have a record of successful in-service performance.

B. Woodwork Institute (WI) Quality Assurance Program: Interior plywood paneling shall be subject to the following WI quality assurance program:

1. Certified Compliance Program (CCP):

a. A WI Certified Compliance Label shall be affixed to the first page of the original shop drawing set.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood panel products until operations that could damage panel products have been completed in installation areas. If panel products must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install paneling 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 paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed and indicate measurements on Shop Drawings.

C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, backing and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

PART 2 - PRODUCTS

2.1 PLYWOOD PANELING

A. Quality Standard: Unless otherwise indicated, comply with the Woodwork Institute's (WI) "North American Architectural Woodwork Standards" (NAAWS) latest edition, Section 8 "Wall Surfacing" for grades of flush wood paneling indicated for construction, finishes, installation, and other requirements.

1. Provide certificates from WI certification program indicating that paneling, including installation, complies with requirements of grades specified.

B. Plywood Paneling for Transparent Finish: Softwood veneer plywood panels complying with DOC PS-1 and ANSI/HPVA-HP-1, made with adhesive containing no urea-formaldehyde.

1. WI Grade: Custom.
2. Face Veneer Species and Face Grades: Douglas fir, Grades as follows:

a. A-D at rooms that are normally occupied.
b. B-D at Storage and equipment rooms.

3. Cut: Rotary sliced.
4. Backing Veneer Species: Any softwood compatible with face species.
5. Construction: Veneer core.
6. Thickness: 3/4 inch.
7. Edge Profile: Square.
8. Panel Size: 48 by 96 inches.
9. Glue Bond: Exposure 1.
10. Face Pattern: Manufacturer's standard machine-sanded surface.
11. Flame Spread Rating: Class C, minimum (flame spread 76-200)
12. Exposed Panel Edges: Applied solid wood banding 11/16 inch thick by depth of panels.

2.2 METAL TRIM

A. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.

1. Basis of Design Manufacturer: Drawings and Specifications are based on products manufactured by:

a. The Fry Reglet Corporation.

1) Subject to compliance with requirements, provide products indicated or equivalent products by one of the following:

a) Gordon, Inc.
b) Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Class II clear anodic finish.

2.3 MISCELLANEOUS MATERIALS

A. Anchors: Type and size as indicated on Drawings.

B. Adhesives: Do not use adhesives that contain urea formaldehyde.

C. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine plywood panels before installation, reject materials that are wet, moisture damaged, mold damaged, or have damaged edges.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installation, condition materials to average prevailing humidity conditions in installation areas for a minimum of 48 hours.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are damaged, unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

B. Grade: Install paneling to comply with same grade as item to be installed.

C. Refer to Division 09 Section “Painting” for final finishing of installed paneling and trim not indicated to be shop finished.

3.4 INSTALLATION OF PANELING

A. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

B. Anchor paneling to supporting substrate with exposed fastening as indicated on Drawings.

3.5 INSTALLATION OF METAL TRIM

A. Install metal trim at exposed vertical and horizontal edges of paneling, at horizontal joints between panels, and at other locations indicated on Drawings.

B. Install metal trim concurrent with installation of plywood wall panels.

C. Install metal trim 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. Anchor metal trim to concealed framing or backing. Secure with countersunk, concealed fasteners.

E. Install trim with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 72 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

3.6 REPAIR, CLEANING, AND PROTECTION

A. Repair damaged and defective paneling and/or trim, where possible, to eliminate defects; where not possible to repair, replace paneling and/or trim.

B. Upon completion of installation, all portions of exposed work shall have handling marks or effects of exposure to moisture removed with a thorough fine sanding using at least 150 grit sandpaper or finer, and shall be cleaned before sealing or finish operations.

END OF SECTION

SECTION 066400
FIBERGLASS REINFORECED PLASTIC PANELING

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 glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

B. Related Sections:

1. Division 09 Section “Gypsum Board.”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated; include installation instructions; product data for panels, trim, and adhesive; and VOC content and chemical components for adhesives and sealants.

B. Samples for Initial Selection: For color and texture selections for paneling and trim accessories.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and 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

2.1 FIBERGLASS REINFORCED PLASTIC (FRP) SHEET PANELING

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Fiberglass Reinforced Plastic Panels: Plastic panels complying with ASTM D 3841 comprised of thermosetting styrenated and acrylated polyester resins reinforced with glass fibers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Kemlite Company Inc.
   b. Marlite.
   c. Nudo Products, Inc.

2. Nominal Thickness: Not less than 0.09 inch.
3. Surface Finish: Molded pebble texture.
4. Color: As selected by Architect from manufacturer's full range of not less than six colors.
5. Surface-Burning Characteristics: Class C as determined according to ASTM E 84 by UL or another acceptable qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 76-200.
   b. Smoke-Developed Index: 450 or less.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Adhesive: As recommended by plastic paneling manufacturer.

1. 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 and complying with requirements in Division 07 Section "Joint Sealants."

1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 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.

3.2 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 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 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.

1. Mark plumb lines on substrate at trim accessory or panel joint locations for accurate installation.
2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels at locations indicated with vertical edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

1. Install panels vertically without horizontal joints unless distance is greater than the maximum available panel length. Where horizontal joints cannot be avoided, provide H-shaped trim between panels.

C. Install panels in a full spread of adhesive.

D. Install trim accessories with adhesive and nails; do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. 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.

3.4 CLEANING

A. Clean panel faces to remove soiling, stains, dust, and dirt using clean rags and cleaning agents as instructed by panel manufacturer.

END OF SECTION

SECTION 071326
SELF-ADHERING SHEET WATERPROOFING

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. Self-adhered sheet waterproofing for application over foam plastic board wall insulation.
2. Protection Course.

B. Related Sections include the following:

1. Division 07 Section “Fluid Applied Waterproofing for Planters” for waterproofing for planters.
2. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Research Reports: For modified bituminous sheet waterproofing/termite barrier, showing compliance with ICC AC380.

D. Qualification Data: For Installer.

E. Field quality-control reports.

F. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by sheet waterproofing manufacturer.

B. Source Limitations: Obtain sheet waterproofing materials through one source from a single manufacturer.

C. Mockups: Build mockups to set quality standards for installation.

1. Build mockup of installation of self-adhering sheet waterproofing over foam plastic board wall installation, coordinated with adjoining Work including metal siding and openings.
2. Build mockup at location and of size indicated by Architect. Area of mockup shall be determined by Architect and shall include typical wall area, terminations, and transitions to other Work.
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.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 SELF ADHERING SHEET WATERPROOFING

A. Modified Bituminous Sheet: Self-adhering sheet consisting of rubberized asphalt laminated on one side to a polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Basis of Design Products: Drawings and specifications are based on the following:

a. Meadows, W. R., Inc.; SealTight Mel-Rol.

1) Subject to compliance with requirements, provide the product specified or a comparable product by one of the following:

a) Carlisle Coatings & Waterproofing Inc.
b) Grace, W. R. & Co.

2. Physical Properties:

a. Thickness: 60 mill overall thickness; 56 mil rubberized asphalt sheet, 4 mil polyethylene film reinforcement.
b. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.

c. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
d. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
g. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
h. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
i. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

F. Sheet Strips: Self-adhering sheet strips of same material and thickness as sheet waterproofing.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

I. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners, 1/8 inch nominal thickness.

1. Basis of Design Product: Drawings and specifications are based on the following:

a. Meadows, W. R., Inc.; Protection Course PC-2, Standard Duty.

J. Protection Course Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

F. Bridge and cover construction and contraction joints and cracks exceeding a width of 1/16 inch with overlapping sheet strips.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

A. Install waterproofing sheets according to manufacturer's written instructions and according to recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

E. Seal edges of sheet-waterproofing terminations with mastic.

F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

G. Immediately install protection course with butted joints over waterproofing membrane.

1. If necessary, temporarily hold protection course in place using recommended adhesive by membrane manufacturer.
2. Backfill immediately using care and caution to avoid damage to waterproofing system.
3. Do not drop backfill material against protection course in such a manner that it could drag the sheet down as backfill drops.

3.4 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

FOR BID ONLY

SECTION 071416
FLUID-APPLIED WATERPROOFING FOR PLANTERS

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. Cold fluid applied waterproofing for planters.
2. Drainage panels.

B. Related Requirements:

1. Division 03 Section “Cast-in-Place Concrete” for concrete planter walls.
2. Division 07 Section “Self-Adhering Sheet Waterproofing” for sheet waterproofing for locations other than planter walls.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings:

1. Show locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including, but not limited to, the following:

a. Surface preparation specified in other Sections.
b. Minimum curing period.
c. Forecasted weather conditions.
d. Repairs.
e. Field quality control.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.

1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

B. Installer's Special Warranty: Warranty signed by Installer covering Work of this Section, for warranty period of two years.

1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Waterproofing system shall be capable of performing as a continuous watertight installation and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Waterproofing shall accommodate normal substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without resultant moisture deterioration.

B. VOC Content: Zero VOC's and compliant with authorities having jurisdiction.

C. Compatibility: Provide waterproofing system materials that are compatible with one another and with adjacent materials under conditions of service and application required, as demonstrated by waterproofing manufacturer based on testing and field experience.

2.2 MANUFACTURERS

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, drainage panels, and accessory products from single source from single manufacturer.

B. Basis of Design Manufacturer: Where named products are indicated, design, Drawings, and Specifications are based on products by the following:

1. Tremco, Inc., Commercial Sealants and Waterproofing Division, an RPM Company.

    a. Subject to compliance with requirements, provide products indicated or submit request for substitution per Division 01 Section "Substitution Procedures."

2.3 COLD FLUID APPLIED WATERPROOFING

A. Cold Fluid-Applied Waterproofing: Two component polyurethane-methacrylate (PUMA)-based liquid membrane.

1. Basis of Design: Tremco Inc.; TREMproof PUMA (horizontal waterproofing system); Tremco PUMA BC or BC LM.
2. VOC Content: 0 g/L, all grades.
3. Elongation ASTM D638 407%.
4. Low Temperature ability and Crack Bridging, ASTM C1305: Pass.
5. Tensile Strength D638 at 75 degrees F1680 PSI.

2.4 ACCESSORY MATERIALS

A. General: Accessory materials as described in manufacturer's written installation instructions, recommended to produce complete waterproofing system meeting performance requirements, and compatible with waterproofing material and adjacent materials.

B. Substrate Patching Material: Waterproofing manufacturer's standard trowel-grade filler material.

C. Primer: Tremco PUMA Primer.

D. Detailing Membrane: Tremco PUMA BC T thixotropic polyurethane methacrylate based membrane for use in detailing and field applied cant beads.

E. Flashing Membrane for Vertical and penetration applications: Tremco PUMA BC R.

F. Crack filler and Patching material: Tremco PUMA WC and silica sand.

G. Top Coat: Tremco PUMA TC.

H. Initiator: Tremco PUMA Initiator/Initiator+, used to catalyze all PUMA/MMA resins.

I. Cleaner: Tremco PUMA Cleaner.

J. Joint Sealant: ASTM C920, approved by waterproofing manufacturer for adhesion and compatibility with waterproofing and accessories; Tremco, Dymonic 100.

K. Expansion Joint Material: Pre-compressed or Closed Cell, Monolithic Foam System. Foam Structure; must not Contain unbonded foam laminations.

1. Products:

a. Willseal® Coreseal; for use in both vertical and horizontal below grade system applications requiring +/-25% movement capability, closed cell, and a lightweight seal.
b. Willseal® Color Coreseal; for use in both vertical and horizontal below grade system applications requiring +/-25% movement capability, closed cell, and a lightweight seal.
c. Willseal® Color Coreseal – CM; for use in both vertical and horizontal below grade Tremco system applications requiring +/-25% movement capability, closed cell, and a lightweight seal with an integrated waterproofing membrane.
d. Willseal® 250 BG; for use in below grade applications, requiring +/- 50% movement capability.

L. Drainage Panel: Molded polystyrene drainage panel with non-woven polypropylene filter fabric; Tremco TREMDrain.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.

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

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off drains and other penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D4258.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

F. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners according to waterproofing manufacturer's written instructions.

G. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and according to ASTM D4258.

3.3 WATERPROOFING APPLICATION

A. Apply waterproofing according to manufacturer's written instructions.

B. Start installing waterproofing in presence of manufacturer's technical representative.

C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.

D. Cold Fluid-Applied Waterproofing: Mix materials and apply waterproofing in total wet film thickness and with methods recommended in writing by waterproofing manufacturer’s application instructions.

1. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft.

E. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates and reapply waterproofing components.

F. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

3.4 DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage manufacturer’s qualified technical representative to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.

1. Manufacturer’s representative shall verify thickness of waterproofing during application for each 100 sq. ft. of installed waterproofing or part thereof.

B. Waterproofing will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION

SECTION 072114
THERMAL FOAM-PLASTIC BOARD WALL 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. Extruded polystyrene (XPS) foam-plastic board insulation for use as a continuous insulation barrier for metal stud framed exterior walls.

B. Related Sections:

1. Division 05 Section “Cold Formed Metal Framing” for exterior wall framing.
2. Division 06 Section “Exterior Gypsum Sheathing” for gypsum panel sheathing installed over stud framing.
3. Division 07 Section “Weather Resistive Barriers” for weather resistive barriers installed as part of the exterior wall system.
4. Division 07 Section “Formed Metal Wall Panels” for metal walls panels installed over foam plastic board wall insulation as part of the exterior wall system.
5. Division 09 Section “Cement Plastering” for cement plaster finish systems applied over foam plastic board wall insulation as part of the exterior wall system.

1.3 SUBMITTALS

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

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (NGX)

A. Extruded Polystyrene Board Insulation (NGX): ASTM C578, Type X, 15-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.

1. Manufacturers: Subject to compliance with requirements, manufacturers providing products that may be incorporated into the Work include, but are not limited to:

a. DiversiFoam Products.
b. Dow Chemical Co.
c. Owens Corning.

2. Properties and Performance Requirements:

a. Panel Thickness: 1-inch.
b. Panel Size: 4 ft. wide by 8 ft. long.
c. Thermal Resistance: (180 day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F): R-5.0 per inch of thickness, with 90% lifetime limited warranty on thermal resistance.
d. Blowing Agent Formulation: Zero ozone depleting.
e. Edge Condition: Square.
f. Surface Burning Characteristics (ASTM E 84): Flame spread less than 25, smoke developed less than 450, certified by independent third party such as Underwriters Laboratories (UL).
g. Indoor Air Quality: Compliance certified by independent third party such as GREENGUARD Indoor Air Quality Certified® and/or GREENGUARD Children and Schools Certified℠.

2.2 ACCESSORY MATERIALS

A. General: Insulation accessories recommended by insulation manufacturer for intended use and compatibility with other system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates designed for fastening insulation boards to substrate.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach insulation to substrate or to another insulation layer.

1. Adhesive shall have a VOC content of 50 g/L or less.

D. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

E. Insulation for Miscellaneous Voids: Spray polyurethane foam insulation, ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 EXTRUDED POLYSTYRENE (XPS) WALL INSULATION INSTALLATION

A. Board Installation: Mechanically fasten insulation board to framing members in compliance with manufacturer's written instructions and as follows:

1. Mechanically attach insulation to framing members; install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

    a. Steel Framing: 5/16 inch.

2. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
3. Begin first course of insulation from a level base line and work upward.
4. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings. Offset joints of insulation from horizontal joints in sheathing.
5. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.

B. Coordinate installation of insulation with installation of substrate materials and materials installed over insulation so insulation is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

C. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

D. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.4 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, moisture, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072116
BLANKET 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. This Section includes:

1. Glass fiber batt/blanket insulation for thermal and acoustical insulation installed in framing cavities.

B. Related Sections:

1. Division 07 Section “Thermal Foam Plastic Board Wall Insulation” for foam plastic board insulation.
2. Division 07 Sections as applicable to roofing for board insulation installed as part of a roofing system.
3. Division 23 Sections as applicable to air distribution duct systems for insulation for ducts.

1.3 SUBMITTALS

A. Product Data: For each type of insulation and accessory.

B. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens-Corning.

C. Glass-Fiber Blanket Insulation, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

D. Glass-Fiber Blanket Insulation, Reinforced-Foil-Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, or foil-scrim polyethylene vapor-retarder membrane on 1 face.

E. Thermal Resistance Values and Thicknesses: Where Drawings indicate thermal resistance values, provide units of the following nominal equivalent thicknesses:

1. R-13; 3-1/2 inch thickness.
2. R-19; 6 inch thickness.
3. R-25; 8 inch thickness.
4. R-30; 10 inch thickness.
5. R-38; 12 inch thickness.

2.2 ACCESSORY MATERIALS

A. Accessory materials shall be as recommended in writing by insulation manufacturer.

B. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION

A. Install insulation in cavities formed by framing members in compliance with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation to provide a complete thermal envelope between the interior and exterior of the building and between conditioned and unconditioned interior spaces.

1. Provide insulation having thermal resistance values indicated on drawings, but not less than the following:

    a. Walls: R-19.

2. Seal joints and fill gaps and voids in insulation using the following materials:

    a. Spray Polyurethane Insulation: Seal joints and fill gaps, voids, and spaces around door and window frames with spray polyurethane insulation; apply according to manufacturer's written instructions.
    b. Glass-Fiber Insulation: Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where it is not feasible to use spray polyurethane insulation; compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

C. Install insulation types according to the following:

1. Vapor-Retarder-Faced Blankets: Install vapor-retarder faced insulation at locations indicated below; install with vapor-retarder membrane to the climate conditioned side of framing.

    a. Exterior Walls: Install vapor retarder faced insulation in stud wall cavities of exterior walls.
    b. Interior Walls: Install vapor retarder faced insulation in stud wall cavities of interior walls between conditioned and unconditioned spaces.

2. Unfaced Blankets: Install in stud wall cavities of interior walls between conditioned interior spaces for acoustical insulation at locations indicated on the Drawings, thickness of insulation to match stud width.

D. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

E. Install vapor barrier faced thermal insulation with manufacturer's R-value label exposed after insulation is installed.

F. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

G. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

H. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

I. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

J. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

K. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

L. Vapor Retarder Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

M. Water-Piping in Walls: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

N. Use mechanical anchorage to provide permanent placement and support of units.

3.4 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, moisture, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072500
WEATHER RESISTIVE BARRIERS

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. Building wrap.
2. Flexible flashing.

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

1. Division 06 Section “Exterior Gypsum Sheathing” for exterior gypsum sheathing.
2. Division 07 Section “Sheet Metal Flashing and Trim.”
3. Division 08 Sections as applicable to doors, windows, and similar wall openings.
4. Division 09 Section “Portland Cement Plastering.”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include data on air and moisture infiltration protection based on testing according to referenced standards.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Building wrap membrane.

C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing weather resistive barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

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

C. Mockups: Before beginning installation, build mockup of weather resistive barrier assembly as directed by Architect, incorporate surface preparation, crack and joint treatment, sealing of gaps and terminations, and coordinate mockup with openings for window and door frames.

1. Approved mockups may become part of the completed Work if undisturbed and undamaged.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in their original undamaged packages in a clean, dry, protected location and in accordance with manufacturer's written recommendations.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Install weather resistive barrier materials within the range of ambient and substrate temperatures recommended by manufacturer. Protect substrates from environmental conditions that affect performance of weather resistive barrier system. Do not apply weather resistive barrier materials to damp or wet substrates or during snow, rain, fog, or mist.

1.7 COORDINATION

A. Coordinate the sequence of installation of weather resistive barrier materials with the installation of exterior wall sheathing and wall finish materials in order to minimize the exposure of sheathing and weather resistive barrier materials to moisture, wind, and sunlight.

PART 2 - PRODUCTS

2.1 BUILDING WRAP

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized.

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. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.

2. Performance Characteristics:

a. Air Penetration: 0.001 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2357.

b. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
c. Water Penetration Resistance: Minimum 280 cm when tested in accordance with AATCC Test Method 127.
d. Basis Weight: Minimum 2.7 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.
e. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
f. Tensile Strength: Minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
g. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
h. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 10, Smoke Developed: 10.
i. Allowable UV Exposure Time: Not less than three months.

2.2 FLEXIBLE FLASHING

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film.

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. DuPont (E. I. du Pont de Nemours and Company).

1) DuPont Flex-Wrap (70 mil), use at door and window heads and sills.
2) DuPont Straight-Flash (30 mil), use at door and window jambs.

2.3 SEALING TAPE AND FASTENERS

A. Sealing Tape: Pressure-sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap, 4 inch minimum width tape.

B. Screws for Fastening Membrane to Steel Framing: Manufacturer's standard corrosion resistant screws with 2-inch diameter plastic washers and of length required to penetrate not less than 1-inch into framing.

2.4 MISCELLANEOUS MATERIALS

A. Primers: Primers as recommended in writing by weather resistive barrier material manufacturer.

B. Sealants: Sealants as recommended in writing by weather resistive barrier material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for weather resistive barrier material application.

B. Treat fins, ridges, other projections, and changes in substrate plane to provide a smooth transition and eliminate sharp projections or edges between surfaces.

3.3 INSTALLATION, GENERAL

A. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

B. Coordinate installation of building wrap with installation of flexible flashing.

C. Coordinate installation of weather resistive barrier materials with installation of wall sheathing and subsequent application/installation of exterior wall finish materials.

3.4 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing at exterior door, window, and similar openings to comply with manufacturers written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
3. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

B. Begin installation of flexible flashing at sills of openings, lap jamb flashing over sill flashing, lap head flashing over jamb flashing.

1. Fasten sill flashing at top edge only to allow for subsequent installation of building wrap membrane behind sill flashing.

3.5 BUILDING WRAP MEMBRANE INSTALLATION

A. General: Install building wrap over exterior side of wall sheathing in accordance with manufacturer's written instructions and as follows.

1. Begin installation of the building wrap at the bottom of the wall, run building wrap horizontally and set level. Install subsequent layers over previous layers lapping horizontal joints not less than 2 inches in shingle fashion for drainage.
2. Overlap building wrap at corners of building by a minimum of 12 inches.
3. Overlap building wrap at vertical seams by a minimum of 6 inches.
4. Seal seams, edges, fasteners, tears, and penetrations with tape.
5. Install building wrap behind flexible sill flashing lapped in shingle fashion to shed water.
6. Extend over jambs of openings and seal corners with tape.
7. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion or control-joint locations.
8. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.
9. Secure building wrap with screws with washers screwed through exterior sheathing and into stud framing. Space fasteners as recommended in writing by building wrap manufacturer.

3.6 PROTECTION

A. Protect weather resistive barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions, until subsequent finishes are applied.

1. Protect weather resistive barrier materials from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace weather resistive barrier materials exposed to these conditions for more than 30 days.

END OF SECTION

SECTION 072616
UNDERSLAB VAPOR RETARDER

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. Under slab vapor retarder for concrete slabs on grade.

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

1. Division 01 Section “Photographic Documentation.”
2. Division 03 Section "Cast-in-Place Concrete."
3. Division 31 Section "Earthwork."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer’s specifications and installation instructions.

B. Testing Documentation: Third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.

C. Samples: For vapor retarder membrane.

D. Digital Photography: Digital photographs of completed installation including seam and penetration sealing, terminations at foundations, and repairs.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Review procedures for field quality control, vapor-barrier installation, steel reinforcement installation, repair procedures, and protection.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened packaging, with labels identifying manufacturer and product.

B. Store materials in accordance with manufacturer's written instructions and to prevent damage.

C. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Do not apply material during rain or during windy conditions.

B. Do not apply on frozen ground.

1.7 COORDINATION

A. Coordinate installation of vapor retarder, reinforcing steel, and placement of concrete to minimize tears and punctures, and to minimize exposure of vapor retarder to sunlight.

PART 2 - PRODUCTS

2.1 VAPOR RETARDERS

A. Plastic Vapor Retarder: Single ply membrane extruded from virgin grade high-impact polyolefin complying with ASTM E 1745, Class A.

1. Available Products: Subject to compliance with requirements, provide one of the following products:

   a. Raven Industries Inc.; Vapor Block 15.
   b. Stego Industries, LLC; Stego Wrap 15 mil.
   c. W.R. Meadows, Inc., Perminator 15.

2. Thickness: 15 mils.
3. Roll Width: 12 feet minimum.
4. Maximum Permeance: One of the following: ASTM E1745 Section 7.1 (7.1.1-7.1.5), permeance of less than 0.01 Perms (grains/(ft^2 · hr · inHg)) after conditioning.

5. Puncture Resistance: ASTM D1709, Method B, not less than 2,266 Grams.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by manufacturer for intended use and compatible with vapor retarder.

B. Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive as manufactured or recommended by vapor retarder manufacturer, minimum width 4 inches.

C. Pipe Boots: Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer's written installation instructions.

D. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions with Installer present for compliance with requirements for conditions affecting performance of the Work.

B. Proceed with installation of vapor retarder only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Level and tamp or roll granular base as specified in Division 31 Section "Earthwork."

3.3 INSTALLATION OF VAPOR RETARDER

A. Vapor Retarders: Place, protect, and repair vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Vapor retarder to be installed over prepared, finely graded subgrade.

B. Unroll vapor retarder and install with the longest dimension parallel with the direction of the pour. Open all folds to the full width.

C. Lap joints 6 inches and seal with manufacturer's recommended tape.

D. Seal holes, openings, and pipe and conduit penetrations in vapor retarder. Fabricate boots around pipes and conduits in accordance with manufacturer's written installation instructions and seal with tape.

E. Areas of adhesion for taped seams, penetrations, and repairs shall be free of dust, dirt, moisture, or other conditions affecting the performance of the tape seal.

F. Terminate vapor retarder at vertical foundation walls by turning up 4 inches against the wall and sealing with tape or fastening with concrete nails spaced 4 feet on center. Where vertical foundation walls do not occur, extend vapor retarder not less than 12 inches into footing trench prior to pouring footings.

G. Coordinate installation of vapor retarder with Work Division 3 Section “Cast-in-Place Concrete.”

1. Use only brick type reinforcing bar supports for reinforcing steel.
2. Avoid driving stakes through vapor retarder membrane, repair all holes.
3. Provide for protection of vapor retarder membrane in high traffic areas.

3.4 FIELD QUALITY CONTROL

A. Immediately after the installation of the vapor retarder, the Contractor, in the presence of the Owner’s Inspector or representative, shall review the completed installation and document the installation using digital photography. Documentation shall include the completed installation, seams, penetrations, terminations, and repairs.

B. After installation of reinforcing steel and just prior to pouring of concrete, the Contractor, in the presence of the Owner’s Inspector or representative, shall review the installed vapor retarder for tears or damage.

C. Inspection reports shall be submitted to the Architect and the Contractor.

3.5 REPAIRS

A. Repair tears and punctures with a vapor retarder patch that overlaps the damaged area by 6 inches in all directions, seal perimeter of the patch with tape.

3.6 PROTECTION

A. Protect installed vapor retarders from damage due to UV light, harmful weather exposures, physical abuse, and other causes until concealed by permanent construction.

B. Remove rain or water from retarder prior to concrete placement by air blowers.

END OF SECTION

SECTION 074213
FORMED METAL WALL PANELS

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. Concealed fastener lap seam metal wall panels including associated trim and flashings.

B. Related Sections:

1. Division 07 Section "Sheet Metal Flashing and Trim" for additional requirements for sheet metal flashing and trim.
2. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

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 each type of panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory and field-assembled work.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Wall Panels: 8 inch square sample for each color selected on same material of panels.

E. Qualification Data: For Installer.

F. Field quality-control reports.

G. Warranties: Samples of special warranties.

H. Maintenance Data: For metal panels to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by panel manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical area including trim, flashing, and accessories as directed by Architect.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Owner’s Inspector, Architect, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of accessories.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review loading limitations of supporting structure.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal panel work to be performed according to manufacturer's written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty, Materials and Workmanship, and Finishes: A single warranty, or warranty from a single entity, shall be provided for steel substrate material, Zincalume base, and factory finishing. Warranties shall apply to, but not be limited to, panels, flashing, and trim.

1. Special Warranty, Material and Workmanship: Manufacturer's standard form in which manufacturer agrees to repair or replace metal panel systems that fail in materials or workmanship within specified warranty period.

a. Failures include, but are not limited to, the following:

1) Structural failures including rupturing, cracking, or puncturing.
2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.

b. Warranty Period: 2 years from date of Substantial Completion.

2. Special Warranty, Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period. Warranty shall include finishes for exposed fasteners.

   a. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

      1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.

   b. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:

   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.

B. Air Infiltration: Air leakage through assembly of not more than 0.01 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a test-pressure difference of 1.57 lbf/sq. ft.

C. Water Penetration (Under Static Pressure): No uncontrolled water penetration when tested according to ASTM E 331 at a test-pressure difference of 6 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURER

A. Basis of Design: Where named Basis of Design manufacturer products are indicated in this section, Design, Drawings, and Specifications are based on products manufactured by the following:

1. Morin, a Kingspan Group Company.

    a. Provide products indicated or submit substitution request per Division 01 Section “Substitution Procedures.”

2.3 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Factory-formed metal wall panels designed to be field assembled by installing horizontally and lapping interlocking top and bottom edges of adjacent panels and mechanically attaching panels to supports using concealed fasteners and factory applied sealant. Include accessories required for weathertight installation.

B. Panel Characteristics: Panel characteristics shall comply with the following:

1. Panel Material: Aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; Grade 40. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Nominal Thickness: 0.042 inch (18 gauge).

2. Panel Depth: 1-1/2 inches nominal.
3. Panel Height: 12 inches nominal coverage.
4. Panel Length: Continuous length up to 30 feet.
5. Panel Surface Texture: Smooth.
6. Finish: Two-coat fluoropolymer.

    a. Color: Selected by Architect from manufacturer’s full range of colors. A separate color may be selected for each panel profile.

C. Basis of Design Panel Profiles:

1. Profile ‘P-9’: Morin; Pulse Series P-9 wall panel.

    a. Profile: Tapered face panel with concave faces tapering to the center of the panel at a slope of approximately 1:6.

2. Profile ‘MX1.0’: Morin; Matrix Series MX1.0 wall panel.

    a. Profile: Box rib design with three 2 inch high ribs starting at the bottom of the panel and three 2 inch high reveals between ribs.
    b. Straight and curved panels are required for project conditions, provide factory curved panels where curved panels are indicated on Drawings.

3. Profile ‘MX2.0’: Morin; Matrix Series MX2.0 wall panel.

    a. Profile: Box rib design with one 6 inch high rib at the bottom of the panel and one 2 inch high rib between two 2 inch high reveals.
    b. Straight and curved panels are required for project conditions, provide factory curved panels where curved panels are indicated on Drawings.

4. Profile ‘MX8.0’: Morin; Matrix Series MX8.0 wall panel.

    a. Profile: Box rib design with one 10 inch high rib at the bottom of the panel and one 2 inch high reveal above.
    b. Straight and curved panels are required for project conditions, provide factory curved panels where curved panels are indicated on Drawings.

D. Factory Formed Corners: Provide factory fabricated inside and outside corners matching panel profiles.

1. Basis of Design: Morin Miterseam Corners, 24 inches by 24 inches.

    a. Material: Same material and thickness as panels.
    b. Finish: Same finish as panels, finish after fabrication.

E. Clip Installation System: Manufacturer’s standard flush clip installation system with clips having pre-drilled attachment holes at one end and panel hook at other end, sized to fit panels; 18 gauge (.0438 Min.), 40ksi yield min., G90 galvanized, material in conformance with ASTM A-653 Class G90.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system and as indicated on Drawings.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fascia, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Flashing and trim formed from same material as panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

1. Thickness: 24 gauge.

D. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Provide exposed fasteners by panel manufacturer with heads finished to match color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

E. Panel Sealants: Provide sealant type recommended by panel manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Curved Panels: Factory form curved panels to radius indicated or required for project conditions.

D. Corners: Factory fabricated mitered corners, structurally bonded, horizontal outside and inside trimless corners matching metal wall panel material, profile and factory applied finish.

E. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

F. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. End Seams for Coil Coated Finished Material: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. End Seams for Field Finished Material: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Exposed Surfaces: Two-coat fluoropolymer AAMA 621 finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

   a. 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70%) solid color coat.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Install panels horizontally in sequence starting at the bottom of walls and work upwards.
2. Install panels and accessories with concealed fasteners to the greatest extent possible.
3. Shim or otherwise plumb substrates receiving metal wall panels.
4. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Install flashing and trim as metal wall panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.

9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof,

form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 075419
POLYVINYL-CHLORIDE (PVC) ROOFING

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. Adhered polyvinyl-chloride (PVC) roofing system.
2. Substrate board.
3. Roof insulation including tapered insulation.
4. Cover board.
5. Walkways

B. Related Sections:

1. Division 05 Section “Steel Decking” for metal decking supporting the roof system.
2. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof flashings and counter flashings.
4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Division 22 Sections as applicable to plumbing fixtures for roof and overflow drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated and to be incorporated into the Work; include the following:

1. Product Data for Solar Reflectance and Emissivity: For roof materials, indicating that roof materials comply with the current requirements of California Title 24, Part 6.

2. Product Data for VOC Content: For adhesives and sealants, including printed statement of VOC content.
3. Laboratory Test Reports: For adhesives and sealants used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Qualification Data: For qualified Installer.

D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

F. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

G. Field quality-control reports.

H. Maintenance Data: For roofing system to include in maintenance manuals.

I. Sample Warranties: For manufacturer's special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's technical

representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 10,000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7 and local building codes.

D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.

E. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

G. Exterior Fire-Test Exposure: Roofing system shall meet the current requirements of CA Title 24, Part 6 and UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation, fasteners, and accessory materials for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

B. Manufacturer, Basis of Design: In other “Part 2 – Products” Articles where named manufacturer products are indicated by “Basis of Design,” Drawings and Specifications are based on products indicated. Provide products indicated, or subject to compliance with requirements indicated, provide comparable products subject to Request for Substitution.

1. Basis of Design Manufacturer: Sika Corporation; Sarnafil.

a. Subject to compliance with requirements, provide products by specified manufacturer or comparable products by one of the following subject to request for substitution:

1) Johns Manville
2) GAF Materials Corporation.
3) Duro Last Roofing, Inc.

2.3 POLYVINYL-CHLORIDE (PVC) ROOF MEMBRANE

A. PVC Sheet: ASTM D D 4434, Type II, Grade 1, Thermoplastic PVC membrane with polyester reinforcement, felt backing, and lacquer coating.

1. Basis of Design: Sika Sarnafil; G410-80 Feltback EnergySmart PVC membrane.
2. Thickness: 80 mils nominal.
3. Exposed Face Color: White.

2.4 FLASHING MATERIALS

A. Flashing Material: Roofing membrane manufacturer's sheet and/or strip membrane flashing of same material, type, reinforcement, 60 mil. thickness, and color as membrane roofing sheet, with or without fabric backing, as recommended by roof system manufacturer.

B. Metal Flashing: Roofing membrane manufacturer's PVC coated, heat weldable metal flashing, ASTM A 653 G90 coating, 24 gauge, with 20 mil PVC membrane factory applied to one side.

1. Basis of Design: Sika Sarnafil; Sarnaclad PVC coated metal flashing sheet.

C. Miscellaneous Flashings: As recommended in writing by membrane manufacturer for detail and warranty conditions indicated.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary roofing materials recommended in writing by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Other Adhesives: 250 g/L.
g. Single-Ply Roof Membrane Sealants: 450 g/L.
h. Nonmembrane Roof Sealants: 300 g/L.
i. Sealant Primers for Nonporous Substrates: 250 g/L.
j. Sealant Primers for Porous Substrates: 775 g/L.

B. Adhesive: Manufacturer's standard complying with VOC limits of authorities having jurisdiction.

C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick.

D. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

F. Sealant: As recommended in writing by membrane manufacturer for conditions indicated complying with VOC limits of authorities having jurisdiction.

2.6 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant Type X gypsum substrate, 5/8 inch thick.

1. Basis of Design: Georgia Pacific; Dens Deck.

2.7 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, inorganic coated glass-fiber mat facer on both major surfaces.

1. Provide two layers of 2.6 inch polyisocyanurate insulation to achieve an R30 insulation value.

C. Tapered Insulation: Factory-tapered insulation boards matching roof insulation and having slope indicated on Drawings.

1. Finished roof slope at tapered insulation areas shall be not less than 1/4 inch per 12 inches.

D. Crickets, and Saddles: Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick.

1. Basis of Design: Georgia-Pacific Corporation; Dens Deck Prime.

2.9 WALKWAYS

A. Flexible Walkways: Roof membrane manufacturer’s reinforced thermoplastic nonporous, surface-textured walkway pads or rolls, 90 mil nominal thickness and 39 inch nominal width.

1. Basis of Design: Sika Sarnafil Sarnatred-V.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any roofing products to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). A separation layer must be placed between metal and ACQ treated wood.

3.4 SUBSTRATE BOARD INSTALLATION

A. Install substrate boards with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

   a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 INSULATION INSTALLATION

A. Coordinate installation of roof system components so no more insulation board is installed than can be covered with roofing membrane by the end of the workday or the onset of inclement weather.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install continuous pressure treated wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Drawings.

1. Thickness shall be as required to match height of substrate board and insulation to allow a smooth transition.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness exceeds 2.5 inches, install insulation in two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction.

E. Install base layer of insulation with end joints staggered not less than 12 inches in adjacent rows.

1. Trim insulation to fit neatly around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. Make joints between adjacent insulation boards not more than 1/4 inch in width.
3. At internal roof drains, slope insulation to create a drain sump with each side equal to the diameter of the drain bowl plus 24 inches, trim insulation so that water flow is unrestricted.
4. Fill gaps exceeding 1/4 inch with insulation.
5. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification to resist uplift pressure at corners, perimeter, and field of roof.
2. Adhere each subsequent layer of insulation to previous layer of insulation in compliance with roofing system manufacturer's written installation instructions for adhered insulation.

G. Install tapered insulation under area of roofing to conform to slopes indicated.

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump, trim cover board so that water flow is unrestricted.
3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity, and FM Global Property Loss Prevention Data Sheet 1-29.

3.7 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Unroll roof membrane and allow to relax before installing.

B. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Apply roofing with side laps shingled with slope of roof deck where possible.

D. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

1. Spray or roller apply adhesive to the substrate in accordance with manufacturer's instructions at rate required by manufacturer.
2. Place membrane into wet adhesive and immediately broom and roll with minimum 100 lb steel membrane roller.
3. Adhesive shall not be used if temperatures below 40°F are expected during application or subsequent drying time.

E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

F. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of three times per day, and repair seam sample areas.
3. Verify field strength of seams by seam test cuts as follows:

a. Perimeters and Corners: Test a minimum of three times per day, and repair seam sample areas.
b. Field Areas: Test a minimum of two times per day, and repair seam sample areas.

4. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

A. General: Flashings shall be installed concurrently with the roof membrane as the Work progresses.

1. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and roofing membrane manufacturer’s technical representative. Approval shall only be for specific locations for specific dates.
2. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at no additional cost to the Owner.

B. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

1. Flashing shall be adhered to compatible, dry, smooth surfaces.
2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

F. Metal Flashings:

1. Metal flashings shall be PVC Laminated metal.
2. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch. Stainless steel fasteners are required when mechanically attaching metal flashing to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). A separation layer must be placed between metal and ACQ treated wood.
3. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

3.9 WALKWAY INSTALLATION

A. Walkways: Install walkway products in locations indicated, adhere walkway products to roof membrane substrate, except edges, and hot air weld edges.

3.10 FIELD QUALITY CONTROL

A. Inspection: Engage roofing system manufacturer's technical representative to be present at preinstallation meeting, to inspect substrate conditions, surface preparation, membrane application, flashings, protection, drainage components, and completed roof installation.

1. Testing shall be performed as directed by roofing system manufacturer’s technical representative.
2. Roof system manufacturer’s technical representative shall prepare inspection reports and submit reports to Architect.
3. Prior to demobilization from the site, the work shall be reviewed by the roofing system manufacturer's technical representative and the Installer. All Deficiencies shall be noted in the inspection report and shall be immediately corrected by the installer to the satisfaction of the roofing system manufacturer's technical representative.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Quality Control of Welded Seams: Installer shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the installer at locations as directed by the manufacturer's technical representative. One inch wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no additional cost to the Owner.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

(ROOFING INSTALLERS WARRANTY Article begins on the next page)

3.12 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: <**Insert date**>.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: <**Insert date**>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   a. Lightning;
   b. Peak gust wind speed exceeding 60 mph;
   c. Fire;
   d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. Vapor condensation on bottom of roofing; and
   g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

SECTION 075600
FLUID-APPLIED ROOF COATINGS

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. Fluid-applied roof coating for exposed steel roof deck including base and finish coats, and accessories.

B. Related Requirements:

1. Division 05 Section “Steel Decking” for steel roof decking.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements and installation, special details, bond testing, protection, and work scheduling.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product incorporated into the Work; include technical data, tested physical and performance properties of products, manufacturer's written instructions for preparing and applying products, and applied thicknesses.

B. Shop Drawings: Show locations and extent of roof coating, accessories, and assemblies specific to Project conditions. Include details for terminations and transitions to adjacent surfaces.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are experienced in applying the same or similar materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original, factory-sealed, unopened containers bearing manufacturer's name and label intact and legible with following information.

1. Name of material.
2. Manufacturer's stock number and date of manufacture.

B. Store materials in protected and well ventilated area. Handle materials to avoid damage.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply products within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.8 WARRANTY

A. Warranty: Provide manufacturer's standard limited material warranty.

PART 2 - PRODUCTS

2.1 FLUID APPLIED ROOF COATINGS

A. Basis of Design Manufacturer: Where named manufacturer products are indicated, Drawings, and Specifications are based on products by the following:

a. The KARNAK Corporation.

1) Subject to compliance with requirements, provide products indicated or comparable products subject to Substitution Request per Division 01 Section “Substitution Procedures.”

B. Source Limitations: Obtain coating materials from a single source from a single manufacturer.

C. Fluid Applied Roof Coatings: Single component, thermoplastic rubber based, fluid applied roof coating.

1. Basis of Design: KARNAK Corp,; 502 RC-W Elasto-Kote Base Coat and 502 RC-W Elasto-Kote Finish Coat.

2. Properties:

a. Base Coat:

1) Weight per Gallon: 9.82 lbs.
2) Solids by Weight: 55 percent.
3) Solids by Volume: 40 percent.
4) VOC Content: Less than 550 g/L.
5) Color: Gray.
6) Hardness, Shore A: 65.
7) Elongation: 715 percent, ASTM D 2370.
8) Tensile Strength: 1,182 PSI, nominal, ASTM D 2370.
9) Permeability: 0.01 perm.
10) Water Absorption (7 days): 0.4 percent.
11) Coverage Rate (Base Coat): 1-1/2 gallons per 100 square feet, 24 mil wet film thickness, 18-20 mil dry film thickness.
12) Service Temperature: -15 to 180 degrees F.
13) Dry Time: 4 to 6 hours at 77 degrees F and 50 percent Relative Humidity.
14) Cure Time: 12 to 24 hours at 77 degrees F and 50 percent Relative Humidity.

b. Finish Coat:

1) Weight per Gallon: 9.78 lbs.
2) Solids by Weight: 54 percent.
3) Solids by Volume: 40 percent.
4) VOC Content: Less than 550 g/L.
5) Color: White.
6) Hardness, Shore A: 65.
7) Elongation: 715 percent, ASTM D 2370.
8) Tensile Strength: 1,182 PSI, Nominal, ASTM D 2370.
9) Permeability: 0.01 perm.
10) Water Absorption (7 days): 0.4 percent.
11) Coverage Rate (Finish Coat): 1-1/2 gallons per 100 square feet, 24 mil wet film thickness, 18-20 mil dry film thickness.
12) Solar Reflectance: Initial, 0.85; 3-year 0.72.
13) Thermal Emittance: Initial, 0.89; 3-year 0.92.
14) SRI: Initial, 107; 3-year, 89.
15) Service Temperature: -15 to 180 degrees F.
16) Dry Time: 4 to 6 hours at 77 degrees F and 50 percent Relative Humidity.
17) Cure Time: 12 to 24 hours at 77 degrees F and 50 percent Relative Humidity.

D. Cleaner: Pre-application substrate cleaner as recommended in writing by coating system manufacturer.

1. Basis of Design: KARNAK Corp.; 799 Wash-N-Prep.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that steel decking installation is complete.

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

3.2 SURFACE PREPARATION

A. Clean substrate according to manufacturer's written instructions using specified cleaner. Rinse substrate surfaces with clean water and allow to completely dry before application of roof coatings. Provide clean, dust-free and dry substrate for coating application.

B. Mask off adjoining surfaces not to be coated to prevent spillage and overspray.

3.3 COATING INSTALLATION

A. Mix and apply base and finish coat materials in accordance with manufacturer's written installation instructions, apply materials within manufacturer's recommended application temperature ranges.

B. Apply coating materials in full contact to abutting surfaces and around protrusions.

C. Spray apply coating materials to fluted steel deck surfaces. Apply at rates and thickness indicated in writing by coating manufacturer.

D. Apply base coat materials and allow to cure before application of finish coat.

E. Apply finish coat over cured base coat.

F. Apply additional material as needed to achieve void and pinhole-free surface.

3.4 CLEANING AND PROTECTION

A. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

B. Remove masking materials after installation.

END OF SECTION

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Formed sheet metal fabrications:

   a. Flashing and trim.
   b. Copings.
   c. Miscellaneous sheet metal fabrications.

B. Related Sections include the following:

1. Division 06 Section “Miscellaneous Rough Carpentry” for wood nailers, curbs, and blocking.
2. Division 07 Sections as applicable to metal roof and wall panels for sheet metal flashing and trim integral with metal roof and wall panel systems.
3. Division 07 Sections as applicable to roofing for sheet metal flashing and trim integral with roofing systems.
4. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.
5. Division 13 Section “Metal Building Systems” for sheet metal integral with metal building roof and wall panel systems.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 SUBMITTALS

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

B. Shop Drawings: For fabricated sheet metal items. Show fabrication and installation layouts including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of special conditions.
6. Details of connections to adjoining work.
7. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

1.5 QUALITY ASSURANCE

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

B. Mockups: Build mockups as required to coordinate with mockups specified in other Sections to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim.
2. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.

4. Review requirements for insurance and certificates if applicable.
5. Review sheet metal flashing observation and repair procedures after flashing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA’s “The Roofing and Waterproofing Manual” and SMACNA's "Architectural Sheet Metal Manual" requirements as applicable for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Sheet metal flashing and trim shall allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

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

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. As-Milled Finish: Mill finish.
2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40.

1. Surface: Smooth, flat and mill phosphatized for field painting.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D 4397.

B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.4 MISCELLANEOUS MATERIALS

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

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. Self-drilling screws, gasketed, with hex-washer head.

2. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Solder for Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

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

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

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

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

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

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

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim as indicated on Drawings and to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a 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.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored and of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams and as follows:

1. Seams for Pre-Finished Metal: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
2. Seams for Unfinished Sheet Steel: Tin edges to be seamed, form seams, and solder.
3. Seams for Unfinished Aluminum: Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

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

H. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

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

1. Expansion Joints: Butt type with cover plate. Space expansion joints not more than 40 feet on center.
2. Gutters: Fabricate from 0.034 inch (22 gage) thick galvanized steel.

B. Downspouts: Fabricate downspouts of size and profile indicated on Drawings complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors. Fabricate from same material and thickness as gutters.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Miscellaneous Roof Flashing: Fabricate in minimum 96-inch long, but not exceeding 10 foot long, sections. Furnish with 6-inch wide joint cover plates. Fabricate from 0.028 inch (24 gage) thick galvanized steel.

1. Joint Style: Lap, 4 inches wide.

B. Copings: Fabricate to cross section indicated in minimum 96-inch long, but not exceeding 10 foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight. Fabricate from 0.028 inch (24 gage) thick galvanized steel.

1. Joint Style: Butt, with 12-inch wide, concealed backup plate and 6-inch wide, exposed cover plates

C. Counterflashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

D. Roof-Penetration Flashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

E. Roof-Drain Flashing: Fabricate from zinc-tin alloy-coated stainless steel, 0.015 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Miscellaneous Sheet Metal Fabrications: Fabricate from 0.028 inch (24 gage) thick galvanized steel unless otherwise indicated.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 UNDERLAYMENT INSTALLATION

A. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.

B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.

6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

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

D. Fastener Sizes:

1. Wood Framing, Blocking, and Sheathing: Use fasteners of sizes that will penetrate [wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
2. Metal Framing, Backing, and Decking: Use fasteners of sizes that will penetrate metal framing, backing, and decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder coil-coated steel and aluminum sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

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

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

1. Fasten gutter to supporting construction as indicated on Drawings.
2. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.

1. Provide elbows at base of downspout to direct water away from building.
2. Connect downspouts to underground drainage system where indicated.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, SMACNA's "Architectural Sheet Metal Manual," and NRCA’s Roofing and Waterproofing Manuals as applicable to project conditions Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Openings Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings, unless shown otherwise on the drawings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

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

3.8 ERECTION TOLERANCES

A. 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.

3.9 CLEANING AND PROTECTION

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

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

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

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

END OF SECTION

SECTION 077233
ROOF HATCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof hatches.
2. Roof hatch guardrails.

B. Related Sections:

1. Division 05 Section "Metal Ladders" for vertical ladders for access to roof hatches and telescoping safety posts for ladders.
2. Division 07 Sections as applicable to roofing systems.

1.3 SUBMITTALS

A. Product Data: For roof hatch and guardrail system. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof hatches and guardrail system; include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions.

C. Operation and Maintenance Data: For roof hatch and guardrail system to include in operation and maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of roof hatches with roof framing, roofing system, flashing, and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS, GENERAL

A. General Performance: Roof hatches and guardrail systems shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs with welded corners, continuous lid-to-curb counterflashing, weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Babcock-Davis.
    b. Bilco Company (The).
    c. Dur-Red Products.
    d. J. L. Industries, Inc.
    e. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    f. Nystrom.

2. Type and Size: Single-leaf lid, 30 by 36 inches.
3. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
4. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (14 gage) thick.

    a. Finish: Baked enamel or powder coat finish.
    b. Color: As selected by Architect from manufacturer's full range.

5. Construction:

    a. Curb Insulation: 1 inch thick cellulosic fiber board.
    b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
    c. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
    d. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

6. Hardware: Spring operators, hold open arm, galvanized steel spring latch with turn handles, galvanized or stainless steel butt or pintle-type hinge system, and padlock hasps inside and outside.

2.3 ROOF HATCH SAFETY RAILING SYSTEM

A. Performance Requirements: Comply with 29 CFR 1910.23 requirements and authorities having jurisdiction including CAL-OSHA.

B. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; and attached to roof hatch.

1. Height: 42 inches minimum above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Maximum Opening Size between Rails: System constructed to prevent passage of a sphere 21 inches in diameter.
4. Gate: Self-closing and self-latching gate fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
7. Fabricate joints exposed to weather to be watertight.
8. Fasteners: Manufacturer's standard, finished to match railing system.
9. Finish: Manufacturer's standard.

2.4 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

C. Steel Tube: ASTM A 500, round tube.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

E. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

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

F. Underlayment:

1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

I. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof hatches and accessories according to manufacturer's written instructions.

1. Install roof hatches and accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof hatches and accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation and fit them to substrates.
4. Install roof hatches and accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

D. Safety Railing Installation: Attach safety railing system to roof-hatch curb.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean bolted connections and abraded areas, and repair galvanizing according to ASTM A 780.

B. Touch up factory-finished surfaces with compatible finish.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace items that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078413
PENETRATION FIRESTOPPING

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. Penetration firestopping systems for the following applications:

   a. Penetrations in fire-resistance-rated walls.

2. Identification of penetration firestopping.
3. Identification of fire separation walls.

B. Related Sections:

1. Division 21, 22, and 23 Sections as applicable to penetrations of fire rated construction by pipes and ducts for plumbing and mechanical work.
2. Division 26 through 28 Sections as applicable to penetrations of fire rated construction by conduit and wiring for electrical, communication, and electronic security work.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

C. Qualification Data: For qualified Installer.

D. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

E. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or has been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements;" and who employs installers experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

D. Do not cover up penetration firestopping system installations that will become concealed behind other construction until each installation has been labeled, examined by Owner's inspecting agency, and building inspector if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Penetration Firestopping Systems: Penetration firestopping systems shall resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Each penetration firestopping system shall be in accordance with firestopping systems tested and approved by one of the following:

1. UL in its "Fire Resistance Directory."
2. Intertek Group in its "Directory of Listed Building Products."
3. FM Approval in its "Approval Guide."

C. Penetration firestopping systems shall be identical to those tested per testing standard indicated.

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grace Construction Products.
2. Hilti, Inc.
3. 3M Fire Protection Products.

B. Wall Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Exposed Penetration Firestopping: Products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. VOC Content of Firestopping Sealants: Provide penetration firestopping sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, or inorganic fibers.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. 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, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions, or any other wall required to have protected openings or penetrations, shall be permanently identified in accessible concealed floor, floor/ceiling, or attic spaces, with signs or stenciling as required by 2019 CBC Section 703.7. Identification shall:

1. Be located in accessible concealed floor, floor/ceiling, or attic spaces.
2. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet horizontal distance measured along the wall or partition.
3. Include lettering not less than 3 inches in height having a 3/8 inch minimum stroke width in a color contrasting with the wall, and incorporating the suggested wording “Fire and/or Smoke Barrier - Protect all Openings” or similar wording.

B. Identification of Penetration Firestopping: Identify penetration firestopping with preprinted metal or plastic labels at each surface penetrated. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Penetration Firestopping - Do Not Disturb."
2. Applicable firestopping system designation and testing and inspecting agency.
3. Manufacturer's name.
4. Date of installation.
5. Contractor's name, address, and phone number.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.
2. Testing and inspecting agency will report test results promptly and in writing to Architect, Division of the State Architect, and Contractor.

3. The cost of additional testing and inspecting of corrected, replaced and/or additional Work will be paid for by the Owner and the cost will be deducted from the contract sum by a change order.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Duties and Responsibilities:

1. Contractor shall maintain control of the quality of materials and workmanship to conform to the drawings and specifications.
2. Facilitate testing and inspection as follows:

   a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
   b. Provide access to the Work for the designated Testing and Inspection Agency.
   c. Furnish all necessary materials and labor to assist the designated testing and inspecting agency in obtaining and handling samples at the project or other sources of materials.

3. Contractor shall correct deficiencies in the Work where tests and inspections indicate the Work does not comply with the Contract Documents.

D. Tests and Inspections: Testing of penetration firestopping stopping shall be conducted by an approved testing agency in accordance with ASTM E 2174.

E. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

F. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Provide UL-classified systems indicated as referenced to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Gypsum Board Wall Penetrations:

1. Blank Opening: WL 0001-0999.
2. Metallic Pipes: WL 1001-1999.
3. Insulated Metallic Pipes: WL 5001-5999.
4. Non-Metallic Pipes: WL 2001-2999.
5. Sheet Metal Ducts: WL 7001-7999.
6. Miscellaneous Electrical Items: WL 6001-6999.
7. Cable Trays: WL 3001-3999.

C. Gypsum Board Wall Terminations:

1. Top of Wall to Concrete/Metal Deck: HWD 0001-0999.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants including mildew resistant silicone joint sealants
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.
5. Joint sealant Backings

B. Related Sections:

1. Division 04 Section "Concrete Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 07 Section "Penetration Firestopping" for sealing joints in fire-resistance-rated construction.
3. Division 32 Section “Concrete Paving Joint Sealants” for exterior concrete paving joint sealants.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product, include documentation for VOC content of sealants and sealant primers.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity employing installers trained and experienced in installing joint sealants similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties shall warrant that all exposed sealants will be guaranteed against any crazing developing on the surfaces of the material, any staining of adjacent surfaces by sealant or by primer (yellowing, etc.), chalking, or color changes on surface of cured sealant.

D. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content: Sealants and primers applied at the Project site shall comply with VOC limits of authorities having jurisdiction; VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and VOC limits of the California Green Building Standards Code (CGBSC), Section 5.504.4.1 and Table 504.4.2 as follows:

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are indicated to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are used in areas of food preparation, use products that comply with 21 CFR 177.2600 and are USDA approved.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

G. Source Limitations: Obtain each kind of joint sealant from a single source from a single manufacturer.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT. neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 790.
   b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
   c. Tremco Incorporated; Spectrem 1.

2. Joint Sealant Application: Exterior joints where one or both joint faces are masonry, stone, concrete or other porous materials and are not to be painted.

B. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 999-A.
   b. GE Advanced Materials - Silicones; Contractors SCS1000.
   c. Tremco Incorporated; Proglaze.

2. Joint Sealant Application: Exterior joints where both joint faces are metal, glass, plastic, or other non-porous material and are not to be painted.

C. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT; formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 786 Mildew Resistant.
   b. GE Advanced Materials - Silicones; Sanitary SCS1700.
   c. Tremco Incorporated; Tremsil 200 Sanitary.

2. Joint Sealant Application: Interior joints between plumbing fixtures and floor or wall surfaces of non-porous materials and are not to be painted.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. BASF Building Systems; Sonolastic NP1.
   b. Pecora Corporation; Dynatrol I-XL.
   c. Sika Corporation, Construction Products Division; Sikaflex - 1a.

2. Joint Sealant Application: Exterior joints of hollow metal frames, exterior joints in concrete and masonry walls, and interior and exterior joints requiring painting.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. BASF Building Systems; Sonolastic SL 1.
   b. Pecora Corporation; Urexpan NR-201.
   c. Sika Corporation. Construction Products Division; Sikaflex - 1CSL.

2. Joint Sealant Application: Interior concrete slab floor joints and exterior paving joints.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. BASF Building Systems; Sonolac.
   b. Pecora Corporation; AC-20+.
   c. Tremco Incorporated; Tremflex 834.

2. Joint Sealant Application: Interior non-moving joints between gypsum board and adjacent materials, trim, or similar surfaces.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex acoustical sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. GE Construction Sealants; RCS20 Acoustical.
   b. Pecora Corporation; AC-20 FTR or AIS-919.
   c. Tremco, Incorporated; Tremco Acoustical Sealant.
   d. USG Corporation; SHEETROCK Acoustical Sealant.

2. Joint Sealant Application: Interior joints of acoustically rated construction and where indicated on Drawings.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Etch concrete and masonry joint surfaces as recommended by manufacturer to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with diluted ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

C. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Install sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead:

1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.
2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.

3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in range of 75 to 125 percent of joint width.

G. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.

H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

3.4 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. General: Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.5 FIELD QUALITY CONTROL

A. General: Provide field adhesion testing when required by manufacturer and/or installer for warranties required of manufacturer and/or installer.

B. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

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

3.6 CLEANING

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

3.7 PROTECTION

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

END OF SECTION

SECTION 081053
DOOR LOUVER AND LITE FRAMES

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. Door lite frames for hollow metal doors.
2. Door louvers and frames for hollow metal doors.

B. Related Sections:

1. Division 08 Sections "Hollow Metal Doors and Frames" for hollow metal doors.
2. Division 08 Section "Glazing" for glass installed in door lite frames.
3. Division 09 Sections “Painting” for field painting louvers and door lite frames.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain door lite frames and door louvers from a single source from a single manufacturer.

B. Basis of Design Manufacturer: In other Part 2 Articles where products are identified by Basis of Design named manufacturer and product, products are based on items manufactured by:

a. Anemostat Door Products.

1) Subject to compliance with requirements, provide products indicated, or comparable products by one of the following:

a) Activar Construction Products Group.
b) Alternate manufacturer subject to request for substitution.

2.2 DOOR LITE FRAMES

A. Metal Frames for Light Openings in Doors: Manufacturer's standard frame formed of steel sheet; factory primed for field finishing.

1. Basis of Design: Anemostat Door Products, LoPro or LoPro-IS Series as required for glass thickness specified.

2. Physical Characteristics:

a. Frame Material: 0.033 inch thick (20 gage) steel of material as follows:

1) Interior Door Lite Frames: Cold rolled steel of thickness indicated.
2) Exterior Door Lite Frames: Hot dipped galvanized of thickness indicated.

b. Size: As indicated on Drawings.
c. Glazing Thickness: As indicated on Drawings.
d. Finish: Baked enamel.
e. Fasteners: Oval head Phillips wood or sheet metal screws.

1) Provide one-way vandal resistant oval head wood or sheet metal screws at exterior doors.

2.3 DOOR LOUVERS

A. Standard Louvers: Manufacturer's standard louver with frame formed of steel sheet; factory primed for field finishing.

1. Basis of Design: Anemostat Door Products, FDLS Series non-vision inverted split ‘Y’ louver.

2. Physical Characteristics:

a. Material:

1) Interior Door Louvers: Cold rolled steel of thickness indicated.
2) Exterior Door Louvers: Hot dipped galvanized of thickness indicated.

b. Frame and Louver Blades: 0.042 inch thick (18 gage) steel.
c. Size: As indicated on Drawings.
d. Free Ventilating Area: 50%.
e. Finish: Baked enamel.
f. Insect Screens: Provide galvanized insect screens for exterior door louvers installed between split louvers.
g. Fasteners: Oval head Phillips wood or sheet metal screws.

1) One-way vandal resistant oval head wood or sheet metal screws at exterior doors.

3. Location: Use for interior doors with louvers.

B. Security Louvers: Manufacturer's standard security louver with frame formed of steel sheet and security grille each side; factory primed for field finishing.

1. Basis of Design: Anemostat Door Products, PLSL Series louver with security grille.

1) Subject to compliance with requirements, provide product indicated or comparable products by one of the following:

a) Approved equivalent subject to request for substitution.

2. Physical Characteristics:

a. Material:

1) Interior Door Louvers: Cold rolled steel of thickness indicated.
2) Exterior Door Louvers: Hot dipped galvanized of thickness indicated.

b. Security Grille: 0.1046 inch thick (12 gage) steel each side of door with 13/16 inch square holes spaced 1 inch on center each way.
c. Louver Blades: 0.032 inch thick (20 gage) steel, non-vision inverted split ‘Y’.
d. Size: As indicated on Drawings.
e. Free Ventilating Area: 50%.
f. Finish: Baked enamel.
g. Fasteners: One-way vandal resistant oval head through bolt, blank one end.
h. Insect Screens: Provide galvanized insect screens for exterior door louvers installed between split louvers.

3. Location: Use for exterior doors with louvers.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy coating designation.

D. Glazing: Comply with requirements in Division 8 Section "Glazing."

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install door louvers and lite frames in accordance with manufacturer's written instructions.

B. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with manufacturer's written instructions.

END OF SECTION

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Hollow-metal frames.
2. Hollow-metal doors including sound transmission control (STC) rated doors.

B. Related Sections:

1. Division 08 Section “Door Louver and Light Frames” for door light frames.
2. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
3. Division 08 Section "Door Hardware" for testing of fire rated door installations egress doors with panic hardware and/or electrified hardware.
4. Division 08 Section "Glazing" for glass installed in hollow metal doors and frames.
5. Division 09 Sections “Painting” for field painting hollow metal doors and frames.
6. Division 26 Sections as applicable for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work vertically under cover at Project site with head up. Place on minimum 4 inch high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. 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. Deliver such items to Project site in time for installation.

B. Coordinate requirements for preparation and installation of electrified door hardware and access control and security systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Deansteel Manufacturing Company, Inc.
5. Metal Products Incorporated (MPI).
6. Steelcraft; an Ingersoll-Rand company.
7. Windsor Republic Doors.

B. Source Limitations: Obtain hollow metal work from a single source from a single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 HOLLOW METAL DOORS

A. General: Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

1. Type/Design: Flush panel unless otherwise indicated on the Drawings.
2. Door Thickness: 1-3/4 inches unless otherwise indicated.
3. Vertical Edges for Single-Acting Doors: Beveled, 1/8 inch in 2 inches.
4. Openings: Factory cut openings in doors.
5. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
6. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
7. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
8. Exposed Finish: Factory prime finish for field painting.

B. Exterior Doors: Doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level.

1. Extra Heavy Duty Doors, Level 3 and Physical Performance Level A.
2. Edge Condition: Model 2, seamless.

3. Face Sheet Material: Fabricated from metallic-coated steel sheet, 0.053-inch minimum thickness (16 gage).
4. Core Construction: One of the following:

    a. Manufacturer's standard polyurethane, or polyisocyanurate core.
    b. Manufacturer’s standard as required to comply with fire-protection and temperature-rise ratings indicated.

5. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints in top edges of doors against water penetration.
6. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.

C. Interior Doors: Doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level.

1. Heavy Duty Doors, Level 2 and Physical Performance Level B.
2. Edge Condition: Model 2, seamless.
3. Face Sheet Material: Fabricated from cold-rolled steel sheet, 0.042-inch minimum thickness (18 gage).
4. Core Construction: As follows:

    a. Non-STC Rated Doors: One of the following:

        1) Manufacturer's standard polyurethane, or polyisocyanurate core.
        2) Kraft paper honeycomb core; one inch cell, phenolic resin impregnated core, laminated to face sheets, full area.

    b. STC Rated Doors: Manufacturer’s standard insulation for STC rated doors.
    c. Fire Rated Doors: Manufacturer’s standard as required to comply with fire-protection and temperature-rise ratings indicated.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

1. Fabricate frames with mitered or coped full profile welded corners unless otherwise indicated.
2. Frames shall be sized to provide full throat width equal to depth of wall including finishes plus 1/2 inch backbend on each side per SDI-100.

B. Exterior Frames: Metallic-coated steel sheet, minimum thickness of 0.067 inch (14-gage).

C. Interior Frames: Cold-rolled steel sheet, minimum thickness of 0.053-inch (16 gage).

D. Exposed Finish: Factory prime finish for field painting.

E. Hardware Reinforcement: Fabricate with reinforcement plates from same material as frames with minimum reinforcement according to ANSI/SDI A250.6 and the following:

1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Closers, and Concealed Holders: Minimum 0.067 inch thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

F. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

H. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor; form from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (20 gage) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy coating designation.

1. Material indicated to be fabricated from metallic coated steel sheet shall be of galvannealed steel sheet.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

F. Glazing: Comply with requirements in Division 8 Section "Glazing."

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 FABRICATION

A. General: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and/or Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.

3. Fabricate exterior frames with an additional flashing flange at the exterior side of frames as indicated on the Drawings.
4. Provide countersunk, flat or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
5. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

    a. For conditions that do not allow for a floor anchor, provide an additional jamb anchor.

7. Jamb Anchors: Provide number and spacing of anchors as follows unless additional anchors are required for fire rating:

    a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames 42 inches or more in width and mounted in metal-stud framed partitions.

    b. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

8. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
5. Provide stops for installation with countersunk flat or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
4. Insulation: Solidly pack mineral-fiber insulation inside frames.
5. Installation Tolerances: Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances. Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Doors: Comply with ANSI/SDI A250.8 as follows:

a. Between Door and Frame at Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch minimum, 1/4 inch maximum.
c. At Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
e. Between Door Face and Stop: 1/16 inch minimum, 1/8 inch maximum.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

3.4 ADJUSTING AND REPAIR

A. Final Adjustments: Final adjustment as specified in Division 08 Section “Door Hardware.”

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 083113
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:

1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 07 Section "Roof Hatches" for roof hatches.
2. Division 22 and 23 Sections as applicable for access to Plumbing and Mechanical valves and equipment behind finished surfaces.
3. Division 26 Sections as applicable for access to Electrical equipment behind finished surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

B. Access Door and Frame Schedule: Provide access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 COORDINATION

A. Coordinate locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work with mechanical and plumbing trades.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babcock-Davis.
2. Dur-Red Products.
3. J. L. Industries, Inc.
4. Karp Associates, Inc.
5. Larsen's Manufacturing Company.
6. Milcor Inc.
7. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Non-Fire Resistance Rated Flush Access Doors and Frames with Exposed Trim: Access doors with face of door flush with frame, with exposed flange and concealed hinge.

1. Material:

a. Uncoated or Metallic Coated Steel Sheet:

1) Locations: Non-fire resistance rated wall and ceiling surfaces of painted gypsum board.
2) Doors: Nominal 0.060 inch (uncoated) or 0.064 inch (coated) (16 gage) thickness.
3) Frames: Nominal 0.060 inch (uncoated) or 0.064 inch (coated) (16 gage) thickness.
4) Finish: Factory prime finish, manufacturer’s standard baked on rust inhibitive gray primer.

b. Stainless Steel Sheet:

1) Locations: Non-fire resistance rated wall and ceiling surfaces with ceramic tile finish or prefinished wall paneling.
2) Doors: Nominal 0.062 inch (16 gage) thickness.
3) Frames: Same material and thickness as doors.
4) Finish: No. 4.

2. Hinges: Manufacturer’s standard concealed spring pin hinge.

3. Latch/Lock:

   a. Latch: Cam latch operated by screwdriver with interior release.

      1) Provide where access doors are located in private or semi-private areas such as office spaces, storage rooms, equipment rooms, and private toilet rooms.

   b. Lock: Manufacturer's standard key operated cylinder cam lock. Furnish two keys per lock and key all locks alike.

      1) Provide where access doors are located in public areas such as exterior walls and ceilings, and public toilet rooms.

4. Size: As indicated on drawings or as required to provide access to valves and equipment concealed behind finished surfaces.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

   1. Finish: Directional satin finish, No. 4.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Size: As indicated on Drawings or size as required for access to concealed spaces, valves, or equipment.

   1. Access to attic spaces shall not be less than 22 x 30 inches clear opening.
   2. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

C. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

D. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal or wood framing, mounting holes shall not be located in exposed surfaces of frames.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.4 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. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

E. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 083313
COILING COUNTER DOORS

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. Counter doors, manual crank operated.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports and for stainless steel counter tops associated with coiling counter doors.
2. Division 08 Section “Overhead Coiling Service Doors” for service doors.
3. Division 08 Section "Door Hardware" for lock cylinders and keying.
4. Division 09 Section “Painting” for field-applied paint finish.

1.3 SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory. Include the following:

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

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

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

D. Qualification Data: For Installer.

E. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than three hours' normal travel time from Installer's place of business to Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of overhead coiling service doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.

1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain coiling counter doors from a single source from a single manufacturer.

B. Manufacturer: Where named manufacturer’s products are indicated as “Basis-of-Design,” Drawings and Specifications are based on products manufactured by:

1. Overhead Door Corp.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) Cornell Iron Works.
2) The Cookson Company.
3) McKeon Rolling Steel Door Company, Inc.

2. Manufacturer of coiling counter doors shall be the same manufacturer as for overhead coiling doors specified in Division 08 Section “Overhead Coiling Service Doors.”

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.3 COILING COUNTER DOOR ASSEMBLIES

A. Basis of Design: Design, Drawings, and Specifications are based on the following:

1. Overhead Door Corp.; Model 650 Coiling Counter Door.

a. Operation: Manual, crank operated.
b. Mounting: Face of jamb mounted with steel guides.
c. Slats: Steel, non-insulated.
d. Finish: Manufacturer’s standard baked on polyester coat finish, color as selected by architect from manufacturer’s standard colors.
e. Fire Rating: None.
f. Locking: Slide bolt at each jamb.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000 cycles; one operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Door Curtains: Manufacturer’s standard interlocking slats continuous for the width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Slat Profile: Flat slats of 1-1/2 inch nominal center to center height.

D. Bottom Bar: Manufacturer's standard continuous channel or tubular shape of material and finish matching slats.

1. Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

E. Curtain Jamb Guides: Formed steel jamb guides, for type of mounting indicated, of finish matching curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

F. Hoods: Hood of hood of same material and finish as door slats. Form to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Shape: Square.

G. Locking Devices: Equip each door with slide-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

H. Operation: Crank operator consisting of crank and crank gearbox, steel crank drive shaft and gear-reduction unit. Size gears to require no more than 25-lbf force to turn crank. Fabricate gearbox to be oil tight and completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

I. Counterbalance Mechanism: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

1. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
2. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
3. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
4. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.4 METAL MATERIALS

A. Galvanized Steel: Hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

B. Stainless Steel Sheet: Type 304, complying with ASTM A 666.

C. Aluminum Sheet: Aluminum sheet complying with ASTM B 209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

D. Aluminum Extrusions: ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" 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 STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's powder coat finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. General: Install coiling counter doors and operating equipment, complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 083323
OVERHEAD COILING SERVICE DOORS

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. Insulated, chain operated overhead coiling service doors, non-fire rated.

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

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 08 Section “Coiling Counter Doors” for coiling counter doors.
3. Division 08 Section “Door Hardware” for cylinders for locks.
4. Division 09 Section "Painting" for finish painting of factory-primed doors.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory; include construction details, material descriptions, dimensions of individual components, profiles for slats, finishes, and furnished accessories.

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

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Qualification Data: For qualified Installer.

E. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than three hours' normal travel time from Installer's place of business to Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of overhead coiling service doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.

1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling service doors from a single source from a single manufacturer.

B. Manufacturer: Where named manufacturer’s products are indicated as “Basis-of-Design,” Drawings and Specifications are based on products manufactured by:

1. The Overhead Door Corp.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) Cornell Iron Works.
2) The Cookson Company.
3) McKeon Rolling Steel Door Company, Inc.

2. Manufacturer of overhead coiling service doors shall be the same manufacturer as for overhead coiling counter doors specified in Division 08 Section “Coiling Counter Doors.”

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Structural Performance, Exterior Doors: Exterior doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to ASCE/SEI 7 and the California Building Code.

1. Wind Loads: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the California Building Code.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.3 INSULATED OVERHEAD COILING SERVICE DOORS

A. Basis-of-Design: Design and specifications are based on the following:

1. Overhead Door Corporation; model 625 Stormtite Insulated Heavy Duty service door.

a. Operation: Chain hoist operated.
b. Mounting: Face of jamb mounted with steel guides.
c. Slats: Insulated steel.
d. Finish: Manufacturer’s standard baked on polyester coat finish, color as selected by architect from manufacturer’s standard colors.
e. Fire Rating: None.
f. Locking: Slide bolt at each jamb.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000 cycles; one operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft at 15 and 25 mph when tested according to ASTM E283 or DASMA 105.

D. Door Curtain: Fabricate overhead coiling-door curtain of interlocking insulated slats designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Slat Material: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch (24 gage) and as required to meet requirements.
2. Profile: Flat profile slats of nominal 2-5/8 inch center-to-center height.
3. Insulation: Insulated doors shall be filled with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.

    a. Thickness of Insulated Slats: 3/4 inch.
    b. Curtain R-Value: 7.7 deg F x h x sq. ft./Btu minimum.
    c. Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
    d. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

4. Slat Finish: Powder-coated finish, color as selected by Architect from manufacturer's full range.

    a. Interior Curtain-Slat Finish: Manufacturer’s standard interior finish.

E. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

F. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel and finished to match curtain slats.

G. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

H. Hood: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Profile: Square.

2. Mounting: Face of wall.
3. Material and Finish: Match slats.
4. Exterior Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

I. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

J. Chain Lock Keeper: Suitable for padlock.

K. Operator: Chain-hoist operator consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

L. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

1. At door head, use 1/8-inch thick, replaceable, continuous sheet secured to inside of hood.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch thick seals of flexible vinyl, rubber, or neoprene.
3. At door threshold, equip door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

M. Counterbalance Mechanism: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

1. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
2. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
3. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
4. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.4 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.

2.5 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's powder coat finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 083613
OVERHEAD BI-FOLD DOORS

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. Upward acting, overhead, two panel bi-fold door assemblies.

B. Related Requirements:

1. Division 05 Section 051200 "Structural Steel Framing" for structural steel supports.
2. Division 05 Section 055000 "Metal Fabrications" for miscellaneous steel supports.
3. Division 08 Section 08800 “Glazing” for glazing used in door panels.
4. Division 26 Sections as applicable for electrical power connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

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

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:

1. Metal finish for doors and framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty [**and finish warranty**].

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

C. Finish warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with provisions in the U.S. Department of Justice's "2010 ADA Standards for Accessible Design" and the California Building Code (CBC)>

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance: Capable of withstanding the design wind loads as indicated on Drawings, and as required by the California Building Code.

1. Deflection Limits: Doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

a. Maximum deflection: 1/300 of opening width.

2. Operability under Wind Load: Doors to remain operable under **design** wind load, acting inward and outward.

C. Seismic Performance: Provide doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Component Importance Factor: 1.0.

2.2 OVERHEAD BI-FOLD DOOR ASSEMBLIES

A. Overhead Bi-Fold Door Assemblies: Two leaf, hinged, overhead stacking doors; two horizontal panels hinged together, weather lapped at horizontal joint; rising vertically on roller and track system fixed to building structure to stack in a folded position under lintel.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. Renlita Doors North America, LLC; S-3000, Foldaway Door Assembly.

1) Provide product specified, or subject to requirements, submit request for substitution per Division 01 Section “Substitution Procedures”

B. Door Size: As indicated on Drawings.

C. Supporting Framework: Welded steel construction fabricated from rolled hollow section steel members with minimum wall thickness of 0.125 inch. Beams shall be designed for maximum dead load deflection of 1/300th part of the span.

1. Load is contained in the jambs and does not require a load bearing header or any additional lateral supports.
2. Operating Channels fabricated from carbon steel hot rolled sheet to comply with ASTM A-36.

D. Door Panel Frames: Door panel frames constructed from carbon steel hot rolled tube complying with ASTM A-500 Grade B and ASTM A-36.

E. Counter Balancing: Counterweight system with enclosed counterweights suspended by 7/19 flexible multi-strand steel cables with minimum safety factor of 6:1. Cable shall be guided in steel sheaves with a minimum sheave to cable diameter ratio of 19:1. Sheaves shall be capable of carrying design loads.

F. Counterweight Covers: Counterweights shall be protected and covered with a removable pressed sheet (aluminum or steel).

G. Finish: Permanently exposed surfaces shall be powder coated; color to be selected by Architect from manufacturer's full range.

H. Fail Safe Mechanism: Mechanical pin lock fail-safe device that prevents door movement automatically in the event of a counterbalance or lifting device failure. Safety brake shall automatically reset once repairs are completed and be capable of repeated engagement without replacement of brake or components.

2.3 DOOR PANEL CLADDING

A. Door Panel Cladding: Insulating glass units set in manufacturer’s standard extruded aluminum window framing with removable stops. Set glazing in vinyl, rubber, or neoprene glazing channel.

1. Window Framing Channels: Manufacturer’s standard extruded aluminum window framing with removable stops.

   a. Finish: Powder coat finish, color to match door framing.

2. Glazing: 1-inch thick insulated tempered glass units as indicated on Drawings and as specified in Division 08 Section “Glazing.”

2.4 MOTOR OPERATOR AND CONTROLS

A. Electric Motor Operator: Electric motor operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Primary Speed Reduction: Worm gear-in-oil-bath reducer. Gear ratio of 39:1 with shaft speed of 34 RPM.
2. Motor Travel: Motor up and down travel is set digitally in the control panel and door position is established by integrated shaft position encoder.
3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with CEC, Class 2 control circuit, maximum 24 V ac or dc.
4. Temperature Rating: -15°F to 125°F
5. Duty Cycle: 100% duty cycle, unlimited number of operations per hour.

6. Motor Electrical Characteristics:

   a. Phase: Single phase.
   b. Volts: 110 AC.
   c. Amps: 6 amps.

B. Control Station: Manufacturer's standard touch screen control station capable of being mounted into single gang electrical box (not provided by manufacturer). Minimum dimensions of the electrical box are 3"x2"x2 1/2" and the box shall be square corner welded construction.

C. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

D. Entrapment Protection: Automatic external entrapment protection consisting of automatic safety sensing devices capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

   1. Primary Entrapment Device: NEMA 4 Monitored Photo Sensors mounted maximum of 6 inches above the finished floor at each side of the door opening interior designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
   2. Secondary Entrapment Device: Manufacturer's proprietary "REDD ALERT™" obstruction sensing technology. Door controls shall monitor the door operation for obstruction during the close cycle. If amperage increases above set limit, the motor shall stop and reverse direction. The sensitivity is set by a qualified installer during initial commissioning and shall be checked and adjusted annually.

E. Control Accessories:

   1. Universal Radio Receiver: Liftmaster™ model 850 LM.

      a. Capable of 310 Mhz, 315 Mhz, or 390 Mhz radio transmitters with Security + 2.0 Remotes.
      b. Direct wires into Renlita REDD™ control panel. Power and controls are administered by REDD™ Control panel.

2.5 METAL FINISHES

A. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

   1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

      a. Aluminum Finish: Comply with AAMA 2603 requirements for pigmented organic coatings applied to aluminum extrusions and panels.

b. Color and Gloss: As selected by Architect from manufacturer's full range.

2.6 SOURCE QUALITY CONTROL

A. Factory Tests:

1. Cycle each motor head and gearbox before packaging to insure proper operation.
2. Bench test each touch screen control panel prior to packaging for proper operation and configuration.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports in accordance with manufacturer's written instructions.

B. Install switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

C. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

D. Fit and align door assembly including hardware.

E. Anchor assembly to wall construction and building framing without distortion or stress. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

F. Power-Operated Doors: Install in accordance with UL 325.

G. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.3 CLEANING AND ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touchup Painting: Provide touch up painting with paints recommended by door manufacturer, replace components than cannot be satisfactorily repaired.

E. Clean doors, frames and glass.

F. Remove temporary labels and visible markings.

3.4 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

3.6 MAINTENANCE

A. Post Installation Maintenance: Contractor and installer shall provide Owner with complete company name, address phone number, fax number and assigned contact for emergency repairs and scheduled maintenance for the installed door(s).

END OF SECTION

SECTION 084113
ALUMINUM-FRAMED ENTRANCES AND CURTAIN WALLS

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. Aluminum curtain wall framing systems.
2. Aluminum framed entrance door systems.

B. Related Sections:

1. Division 08 Section "Door Hardware" for swinging aluminum entrance door hardware not specified in this section.
2. Division 08 Section "Translucent Wall Assemblies" for translucent wall assemblies.
3. Division 08 Section "Glazing" for glass for glazing of aluminum curtain wall systems.

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 aluminum-framed systems.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. Include details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and curtain walls, showing the following:

   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.

3. Include point to point wiring routing for electrically operated or controlled door operating hardware.

C. Governing Agency Deferred Approval: Projects under the jurisdiction of the Division of the State Architect (DSA) require window systems with framing member spans greater than 10 feet to have the design of framing members reviewed and approved by the Division of the State Architect through a Deferred Approval (Refer to DSA Interpretive Regulation IR 24-2 for additional information; IR 24-2 is available on DSA's website).

1. Window system Deferred Approval submittal shall include necessary shop drawings, details, and structural calculations prepared, stamped, and signed by a structural engineer licensed in the State of California. The window framing supplier or installer shall be responsible for the design and engineering calculations and drawings, and shall be responsible for responding to and resolving any comments from the DSA.
2. The Deferred Approval submittal shall be submitted to the Architect through the General Contractor. The Architect will transmit the Deferred Approval submittal to the Division of the State Architect.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Qualification Data: For installer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

I. Field quality-control reports.

J. Sample Warranties: For special warranties.

K. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. 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.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.5 MOCKUPS

A. Mockups: Build mockups to verify compliance with Specifications, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at location(s) as directed by Architect.

   a. At least one mockup shall be required for each different installation condition and shall include head, jamb, and sill conditions.

2. Mockup of curtain wall framing shall be integrated and coordinated with associated weather resisting components including but not limited to weather resistive barriers, exterior wall insulation, flashing, wall finishes.
3. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 COORDINATION

A. Coordinate installation of products specified in this Section with installation of products specified in the following Sections:

1. Division 07 Section “Weather Resistive Barriers.”
2. Division 07 Section “Sheet Metal Flashing and Trim.”
3. Division 08 Section "Translucent Wall Assemblies" for translucent wall assemblies.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures, including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design aluminum-framed entrances and curtain walls, including comprehensive engineering analysis, using performance requirements and design criteria indicated.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and curtain walls shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferring to building structure.
    c. Glass breakage.
    d. Noise or vibration created by wind and thermal and structural movements.
    e. Loosening or weakening of fasteners, attachments, and other components.
    f. Failure of operating units.
    g. Sealant failure.

C. Structural Design Wind Loads: Curtain wall assemblies shall be designed to withstand wind loads determined according to ASCE/SEI 7 and the 2019 California Building Code.

1. Wind Loads: As indicated on Drawings and not less than 20 lbf/sq. ft., acting inward and outward.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

E. Structural Testing: Aluminum-framed curtain wall systems shall comply with testing according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, curtain wall assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Resistance: No water leakage when measured in accordance with ASTM E331 with a static test pressure of 8 psf for curtain wall framing and 15 psf for curtain wall framing.

G. Dynamic Water Resistance for Curtain Wall Framing: No water leakage, when measured in accordance with AAMA 501.1-94 with a dynamic test pressure of 15PSF.

H. Water Penetration Under Static Pressure: Test according to ASTM E331; there shall be no evidence water penetration through fixed glazing and framing areas, including entrance doors, when tested according to minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than of 6.25 psf.

I. Seismic Performance: Aluminum framed entrances and curtain wall assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the 2019 California Building Code.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

J. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.65 Btu/sq. ft. x h x deg F as determined according to AAMA1503.1.

2. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. as measured according to ASTM E 283.
b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

3. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined according to AAMA 1503.1
b. Entrance Doors: CRF of not less than 55 as determined according to AAMA 1503.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes of 120 degrees F ambient and 180 degrees F material surface.

L. Accessibility Requirements for Entrances: Comply with applicable requirements of the 2010 ADA Standards for Accessible Design, ICC/ANSI A117.1, and the 2019 California Building Code.

2.2 MANUFACTURERS

A. Basis-of-Design Products: In other Part 2 Articles where named products are indicated, design, Drawings, and Specifications are based on products manufactured by:

1. Arcadia, Inc.

   a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

      1) EFCO Corporation.
      2) Kawneer North America; an Alcoa company.
      3) Oldcastle Building Envelope.
      4) United States Aluminum.

B. Source Limitations: Obtain all components of aluminum-framed entrance and curtain wall system, including framing and accessories, from a single source from a single manufacturer.

2.3 ALUMINUM CURTAIN WALL FRAMING SYSTEMS

A. Framing Members: Manufacturer's extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

   a. Arcadia, Inc.; T-500 – OPG2900 Series thermally broken aluminum curtain wall framing.

2. Size: 2-1/2 inches by 7 inches nominal.
3. Construction: Thermally broken.
4. Glazing System: Retained mechanically with gaskets on four sides, may be installed from inside or outside.
5. Glazing Plane: Front.
6. Glazing Thickness: 1-inch, unless otherwise indicated.
7. Finish: High performance organic coating.
8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
9. Steel Reinforcement: As required by manufacturer.

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing; include snap-on aluminum trim that conceals fasteners.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

2.4 ENTRANCE DOOR SYSTEMS

A. Standard Duty Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation fabricated from extruded-aluminum tubular stiles rails.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

   a. Arcadia, Inc.; Model WS512 wide stile entrance doors.

2. Door Stile Design: Wide stile design.

   a. Vertical Stile Width: 5 inches nominal not including glazing stops.
   b. Top Rail: 5 inches nominal minimum not including glazing stops.
   c. Bottom Rail: 10 inches wide minimum not including glazing stops.

3. Door Width and Height: As indicated on Drawings.
4. Overall Thickness: 1-3/4 inches.
5. Material Thickness: 0.125 inch thick, extruded-aluminum tubular rail and stile members.
6. Glazing: 1 inch thick insulated glazing.
7. Finish: High performance organic coating.

B. Glazing Stops and Gaskets: 0.050 inch thick, square, snap-on, extruded-aluminum stops and preformed gaskets, finish to match door.

1. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Division 08 Section "Door Hardware."

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

C. Door Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

2.6 GLAZING

A. Glazing: Glazing shall be as specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Glazing Sealants: As recommended by curtain wall system manufacturer.

1. Sealants shall comply with requirements specified in Division 07 Section “Joint Sealants.”
2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Framing System Gaskets: Manufacturer's standard as recommended by manufacturer.

C. Perimeter Joint Sealants: As recommended by curtain wall system manufacturer.

1. Sealants shall comply with requirements specified in Division 07 Section “Joint Sealants.”
2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

F. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.8 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior or exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. Provide compression weather stripping at fixed stops at all doors.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

3. Door stiles and rails shall have hairline joints at corners. Heavy concealed reinforcement brackets shall be secured with screws and shall be of deep penetration and fillet welded.
4. All doors shall have an adjusting mechanism in the top rail to provide for minor clearance adjustments.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, 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.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

I. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

J. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

K. Install glazing as specified in Division 08 Section "Glazing."

L. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

M. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
   c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and curtain walls as directed by Architect.

1. Testing shall be performed by the Contractor in the presence of the Owner's Inspector. The Owner's Inspector shall be responsible for observing and reporting results of testing.
2. Water-Spray Test: Before installation of interior finishes has begun, areas of curtain wall framing and glazing designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

    a. Perform a minimum of three tests per building at areas as directed by Architect.

B. Aluminum curtain wall framing will be considered defective if they do not pass tests and inspections.

C. Inspection Reports: Inspection reports shall be prepared by the Owner's Inspector.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer and as specified in Division 8 Section "Door Hardware."

END OF SECTION

SECTION 084513
TRANSLUCENT WALL ASSEMBLIES

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. Translucent wall assemblies including aluminum framing, polycarbonate translucent glazing, and accessories for a complete installation.
2. Delegated design submittal for DSA review and approval.

B. Related Sections:

1. Division 5 Section “Structural Steel Framing” for structural steel framing.
2. Division 5 Section “Cold Formed Metal Framing” for steel stud wall framing.
3. Division 5 Section “Metal Fabrications” for miscellaneous steel framing.
4. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
5. Division 08 Section “Aluminum Entrances and Curtain Wall” for curtain wall framing.

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 aluminum-framed systems.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. Include details of each type of vertical-to-horizontal intersection of curtain wall framing, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

C. Governing Agency Deferred Approval: Projects under the jurisdiction of the Division of the State Architect (DSA) require window systems with framing member spans greater than 10 feet to have the design of framing members reviewed and approved by the Division of the State Architect through a Deferred Approval (Refer to DSA Interpretive Regulation IR 24-2 for additional information; IR 24-2 is available on DSA's website).

1. Window system Deferred Approval submittal shall include necessary shop drawings, details, and structural calculations prepared, stamped, and signed by a structural engineer licensed in the State of California. The curtain wall supplier or installer shall be responsible for the design and engineering calculations and drawings, and shall be responsible for responding to and resolving any comments from the DSA.
2. The Deferred Approval submittal shall be submitted to the Architect through the General Contractor. The Architect will transmit the Deferred Approval submittal to the Division of the State Architect.

D. Samples for Initial Selection: For units with factory color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Qualification Data: For installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency indicating compliance with performance requirements.

1. The glazing panels must be evaluated and listed by recognized building code evaluation organization: International Council Evaluation Service Inc (ICC-ES).

H. Field quality-control reports.

I. Sample Warranties: For special warranties.

J. Maintenance Data: For curtain wall systems to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 MOCKUPS

A. Mockups: Build mockups to verify compliance with Specifications, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at location(s) as directed by Architect.

a. At least one mockup shall be required for each different installation condition and shall include head, jamb, and sill conditions.

2. Mockup of curtain wall framing shall be integrated and coordinated with associated weather resisting components including but not limited to weather resistive barriers, exterior wall insulation, flashing, wall finishes.
3. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 COORDINATION

A. Coordinate installation of products specified in this Section with installation of products specified in the following Sections:

1. Division 07 Section “Weather Resistive Barriers.”
2. Division 07 Section “Sheet Metal Flashing and Trim.”
3. Division 08 Section “Aluminum Entrances and Curtain Wall” for curtain wall framing.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of curtain wall systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures, including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Painted Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design translucent wall assembly, including comprehensive engineering analysis, using performance requirements and design criteria indicated.

B. Structural Performance: Comply with performance requirements specified, as determined by testing of translucent wall assembly representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Translucent wall assembly shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Glazing panel breakage.
d. Noise or vibration created by wind and thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Sealant failure.

C. Structural Design Wind Loads: Curtain wall systems shall be designed to withstand wind loads determined according to ASCE/SEI 7 and the 2019 California Building Code.

1. Wind Loads: As indicated on Drawings and not less than 20 lbf/sq. ft., acting inward and outward.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/120 of the edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

E. Structural Testing: Translucent wall assemblies shall comply with testing according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, curtain wall assemblies do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Seismic Performance: Translucent wall assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the 2019 California Building Code.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes of 120 degrees F ambient and 180 degrees F material surface.

2.2 SOURCE LIMITATIONS

A. Obtain all components of translucent wall system from single manufacturer and from a single source.

2.3 TRANSLUCENT WALL ASSEMBLIES, BASIS OF DESIGN

A. Basis-of-Design: Drawings and Specifications are based on the following:

1. Kingspan Light + Air; UniQuad Translucent Wall System.

a. Provide translucent wall system indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”

2.4 TRANSLUCENT GLAZING PANELS

A. Polycarbonate Glazing Material:

1. Translucent glazing panels shall be constructed of polycarbonate with tight cell sizes not exceeding 0.18 inch.
2. Glazing shall be factory sealed to restrict dirt ingress.
3. Glazing shall be manufactured with a permanent, co-extruded ultra-violet protective layer. Post-applied coatings or films of dissimilar materials shall not be acceptable.
4. The light transmission shall not decrease more than 6% as measured by ASTM D-1003 over 10 years, or after exposure to temperature of 300° for 25 minutes (thermal aging performance standard).
5. Blue light spectrum (400-470nm) measured in accordance with ASTM E-1175 shall not decrease by no more than 6% after ten years in comparison with the original value.
6. The weathering performance should be justified by successful testing of the glazing's performance after exposure to actual Florida weather conditions for approximately 10 years in comparison to a new glazing assembly. This performance must be demonstrated by providing independent lab test reports for the exposed and a new panel assembly for the following tests; test results must show that there is no deterioration in performance for the 10 year's exposed panels versus new:

    a. Uniform static air pressure per ASTM E-330 at negative load of -105 PSF and positive load of 130 PSF.
    b. Impact loading of 500 ft lbs. per ASTM E-695.
    c. Cyclic static air pressure at 65 PSF and impact lever D per ASTM 1886 and ASTM E-1996.

7. Glazing shall not become readily detached when exposed to temperatures of 300°F and 0°F for 25 minutes.
8. Thermal aging; the interior and exterior glazing shall not change color in excess of 0.75 Delta E per ASTM D-2244 and shall not darken more than 0.3 units Delta L per ASTM D-2244 and shall allow no cracking or crazing when exposed to 300°F for 25 minutes.

B. Translucent Glazing Assemblies: Unitized Double Glazed panel assemblies of two independent insulated glazing panes in one integrated assembly, incorporated into a complete aluminum frame system that has been tested and warranted by the manufacturer as a single source system. Design shall provide for the replacement of the exterior glazing, independently of the interior glazing without exposing the building's interior or compromising the weather tightness or interfering with the normal working functions of the building.

1. Overall glazing assembly thickness shall be 4.25 inches, with two glazing panes and concealed interlocking connector. Thickness of the exterior and interior glazing shall be minimum 8mm thick each.
2. Exterior Glazing Color: Clear Matte.
3. Interior Glazing Color: Clear Matte.

C. Thermal and Solar Performance

1. Product U-Values shall be listed in the NFRC Product Directory and have a NFRC Certified Product Directory (CPD) number.

   a. Basis of Design CPD Number: CPI-M-3 / CPI-M-5.

2. System U-Value per NFRC 100 and 700 with a Mill finish: 0.29 to 0.17 subject to color selection.
3. Each unitized glazing assembly shall be thermally broken.
4. Visible Light Transmission: Center of Glass (VT%) of 0.34 to 0.10 subject to color selection; per ASTM E-972 and E-1084.
5. Solar Heat Gain Coefficient (SHGC) 0.34 to 0.18 subject to color selection per NFRC Calorimeter.
6. Haze measurement minimum of 90% per ASTM D-1003.

D. Translucent Glazing Joint System

1. Water penetration: No water penetration of the glazing joint connection length at test pressure of 6.24 PSF per ASTM E-331.
2. Air Infiltration: Pass requirements of NFRC 400 at 1.57 PSF and 6.24 PSF.
3. Free movement of the glazing shall be allowed to occur without damage to the weather tightness of the completed system.
4. The glazing joint shall comply with the deflection limitation of CBC Table 1604A.3 for exterior walls with flexible finishes, L/120 per ASTM E-330.

E. Flammability: Exterior and interior polycarbonate glazing:

1. Class CC1 fire rating classification per ASTM D-635. Square foot and separation limitations provided in CBC Table 2607.4 (Light transmitting plastic having a CC2 fire classification rating is not acceptable).
2. Class A interior flame spread per ASTM E-84.
3. Flame spread no greater than zero (0) and smoke density no greater than 110 per ASTM E-84.
4. Minimum self-ignition temperature of 1120° per ASTM 1929.

F. Impact Resistance

1. Minimum Impact resistance of 350 ft. lbs. per SFBC – PA 201-94.
2. Minimum Impact loading of 500 ft. lbs. per ASTM E-695.
3. Comply with standard specification for performance of exterior windows or curtain walls when impacted by windborne debris at level D and after cyclic wind loading at the specified design load (ASTM E1996-02).

2.5 METAL TRANSLUCENT WALL PANEL ASSEMBLY FRAMING

A. Design criteria shall be per ASCE-7 requirements and as indicated on the Structural Drawings.

B. The translucent wall light framing is designed to be self-supporting between the support constructions. The deflection of the glazing panel joint and system framing members in a direction normal to the plane of the glazing, when subjected to a uniform load deflection, shall not exceed L/120 for the unsupported span per CBC Table 1604A.3. All adjacent and support construction must support the transfer of all loads included horizontal and vertical, exerted by the system.

C. All translucent wall assembly aluminum framing exposed to the exterior shall be thermally broken.

D. Water penetration: the wall system shall allow no water penetration at a minimum differential static pressure of 6.24 PSF per AAMA 501 pressure difference recommendations and as demonstrated by prior testing of typical framing sample per ASTM E-331

E. Water test of meal frame structure shall be conducted according to procedures in AAMA 501.2.

F. Maximum air infiltration rate for fenestration of the two glazing assemblies of wall system shall be per NFRC 400.

2.6 METAL MATERIALS

A. Aluminum:

1. Alloy and temper recommended by manufacturer for type of use and finish indicated.

    a. Sheet and Plate: ASTM B 209.
    b. Extruded Profiles: ASTM B 221, 6063-T6 or 6005-T5.
    c. Extruded Structural Pipe and Tubes: ASTM B 429.
    d. Structural Profiles: ASTM B 308/B 308M.
    e. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2. Finish of exposed aluminum members:

    a. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.

        1) Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
        2) Color and Gloss: As selected by Architect from manufacturer's full range.

            a) Color to match color of curtain wall framing specified in Division 08 Section “Aluminum Entrance and Curtain Wall Framing.”

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.7 ACCESSORIES

A. Flashing: Aluminum, 5005 H34, 0.040-inch thick.

1. Sill flashings are to be furnished shop formed to profile; when lengths exceed 10ft, provide in nominal 10ft lengths. Field trimming of the flashing and field forming the ends is necessary to suit as-built conditions. Sheet metal ends are to overlap at least 6 inches to 8 inches, set in a full bed of sealant and riveted if required.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Fasteners for aluminum framing shall be stainless steel or cadmium plated steel, excluding the final fasteners to the supporting structure.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. Reinforce members as required to receive fastener threads.
4. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

C. Perimeter Joint Sealants: As recommended by curtain wall system manufacturer.

1. Sealants shall comply with requirements specified in Division 07 Section “Joint Sealants.”
2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

F. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior or exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Translucent Wall Assembly Framing: Fabricate components for assembly using manufacturer's standard assembly method.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, 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.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions and approved shop drawings.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

3.3 ERECTION TOLERANCES

A. Install translucent wall system to comply with the following maximum erection tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
   c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of translucent wall system assemblies as directed by Architect.

1. Testing shall be performed by the Contractor in the presence of the Owner's Inspector. The Owner's Inspector shall be responsible for observing and reporting results of testing.
2. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

   a. Perform a minimum of three tests at areas as directed by Architect.

B. Translucent wall system assemblies will be considered defective if they do not pass tests and inspections.

C. Inspection Reports: Inspection reports shall be prepared by the Owner's Inspector.

3.5 CLEANING

A. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, cleaning wiping cloths. Always test a small area before applying to an entire area.

B. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use. Always test a small sample to validate compliance before applying to the entire glazing surface.

C. Installer shall leave glazing system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

END OF SECTION

SECTION 086200
UNIT SKYLIGHTS

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. Fixed, non-operable unit skylights with self-flashed curbs.

B. Related Requirements:

1. Division 05 Sections “Structural Steel Framing,” “Steel Decking,” and “Metal Fabrications” for support framing for skylights.
2. Division 07 Section "Polyvinyl Chloride (PVC) Roofing" for roofing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of unit skylight.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.

B. Shop Drawings: For unit skylight work.

1. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type and size of unit skylight, for tests performed within the last four years by a qualified testing agency. Test results based on testing of smaller unit skylights than specified will not be accepted.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For unit skylights to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skylights installed by single installer with minimum of five (5) years demonstrated experience in installing products of same type and scope as specified.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Uncontrolled water leakage.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Breakage of polycarbonate glazing.
d. Deterioration of insulating-glass hermetic seal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Unit Skylight Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

B. Thermal Transmittance: NFRC 100 maximum U-factor of 0.75 Btu/sq. ft. x h x deg F.

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC of 0.30.

D. OSHA: Skylights shall comply with OSHA fall protection requirements.

2.2 UNIT SKYLIGHTS

A. Skylights: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, inner frames, and self-flashed curbs that are capable of withstanding performance requirements indicated.

B. Basis of Design: Design, Drawings, and Specifications are based on the following:

1. KingSpan Light + Air; Tufflight series skylight.

   a. Subject to compliance with requirements, provide product indicated or a comparable product subject to substitution request per Division 01 Section "Substitution Procedures."

C. Skylight Characteristics:

1. Size: 3 ft. x 6 ft. nominal size and shape as indicated on Drawings.
2. Glazing: Polycarbonate glazing, thermoformable, extruded monolithic sheets, UV resistant, burglar-resistance rated according to UL 972, and with average impact strength of 12 to 16 ft-lb/in. of width when tested according to ASTM D256, Test Method A (Izod).

   a. Glazing: Double dome glazing as follows:

      1) Glazing Profile: Dome, 25 percent rise.
      2) Thicknesses: Not less than thicknesses required to exceed performance requirements.
      3) Outer Glazing Color: White polycarbonate.
      4) Inner Glazing Color: Clear polycarbonate.

   b. Self-Ignition Temperature: 650 deg F or more for plastic sheets in thickness indicated when tested according to ASTM D1929.
   c. Smoke-Production Characteristics: Smoke-developed index of 450 or less when tested according to ASTM E84, and smoke density of 75 or less when tested according to ASTM D2843
   d. Burning Characteristics: Tested according to ASTM D635. Class CC1, burning extent of 1 inch or less for nominal thickness of 0.060 inch or thickness indicated for use.

3. Glazing Gaskets: Manufacturer's standard.
4. Frame: Manufacturer's standard thermally broken welded aluminum frame for self-flashed curb with sealing tape.

   a. Thermal Break: Manufacturer's standard, AAMA compliant.
   b. Condensation Control: Integral internal gutters and non-clogging weeps to collect and drain condensation to the exterior.
   c. Frame Cap: Manufacturer's standard welded aluminum, mill finish.
   d. Sealing Gasket: Manufacturer's standard engineered thermoplastic.

D. Curb: Self-flashed, extruded-aluminum, double wall curb.

1. Material: Extruded-aluminum, ASTM B221, alloy and temper to suit structural and finish requirements but with not less than the strength and durability of Alloy 6063-T52 or 6063-T6.
2. Height: 12 inches.
3. Construction: Double wall, insulated with manufacturer's standard rigid or semirigid insulation, 1 inch minimum thickness.

2.3 ACCESSORY MATERIALS

A. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

C. Curb seal tape: 1-1/2” wide Ethylene Propylene Diene Monomer tape.

2.4 FABRICATION

A. Factory assemble and glaze skylights ready for installation.

B. Fabricate skylights weather tight and free of visual distortions and defects.

C. Protect exterior drip/counter flashing and drainage ports from weather and airborne debris.

D. Miter and full penetration weld corners of curb and retaining frames.

E. Seal retaining frames securing glazing panels along each side under spring tension with silicone sealant along full perimeter of retaining frame.

F. Pre-drill frames for anchorage to roof curbs.

G. Seal glazing panels to base frame with allowance for expansion and contraction.

H. Provide exterior weep hole arrangement.

2.5 ALUMINUM FINISHES

A. Mill Finish: Manufacturer's standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, 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.

3.2 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.

C. Install unit skylights level, plumb, and true to line, without distortion.

D. Anchor unit skylights securely to supporting substrates.

E. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.

3.3 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Commercial door hardware for swinging doors.
2. Testing of egress doors with panic hardware and/or fire rated door assemblies as required by NFPA 101.

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

1. Division 08 Section "Hollow Metal Doors and Frames."
2. Division 08 Section “Aluminum Entrances and Storefronts.”
3. Division 26 Electrical Sections as applicable for connections to electrical power system and for low-voltage wiring work for electrified hardware.

1.3 REFERENCES AND ABBREVIATIONS

A. Industry standard references and abbreviations shall be as follows:

1. ADA: Americans with Disabilities Act (ADA), 2010 ADA Standards for Accessible Design.
2. BHMA: Builders' Hardware Manufacturers Association.
3. CCR: California Code of Regulations, Title 24, Part 2, California Building Code.
4. DHI: Door and Hardware Institute.
5. NFPA: National Fire Protection Association.

    a. NFPA 80: Fire Doors and Windows.
    b. NFPA 101: Life Safety Code.
    c. NFPA 105: Smoke and Draft Control Door Assemblies
    d. NFPA 252: Fire Tests of Door Assemblies.

6. UL - Underwriters Laboratories.

    a. UL 10C: Positive Pressure Fire Tests of Door Assemblies.
    b. UL 305: Panic Hardware.

7. WHI: Warnock Hersey Incorporated.

8. SDI: Steel Door Institute.
9. NAAMM: National Association of Architectural Metal Manufacturers.

1.4 SUBSTITUTIONS

A. Substitutions: Substitutions will only be allowed by substitution requests submitted in accordance with Division 01 Section “Substitution Procedures” prior to the bid date.

1. In Part 2 Articles where manufacturers are listed for various product types and only one manufacturer is listed with no alternate manufacturers indicated, manufacturer listed is an established Owner standard and substitutions will not be allowed.

1.5 SUBMITTALS

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

B. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule. Organize schedule vertically into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include the following information:

1. Type, style, function, size and finish of each hardware item.
2. Name, part number and manufacturer of each item.
3. Fastenings and other pertinent information.
4. Location of hardware set coordinated with floor plans and door schedule.
5. Explanation of all abbreviations, symbols and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.
8. List of manufacturers used and their nearest representative with address and phone number.
9. Keying information.
10. Manufacturer’s catalog cut sheets.

C. Wiring Diagrams: Power, signal, and control wiring for electrified hardware. Include interface between electrified hardware and control system wiring.

D. Meeting and Conference Minutes: For Keying and Preisntallation conferences.

E. Qualification Data: For Door Inspector. Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4 and/or a copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

F. Field quality-control reports.

G. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include “as installed” final hardware and keying schedule.

H. As-Built Schedule: As-built/as-installed schedule with closeout documents, including keying schedule, wiring diagrams, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

I. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

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

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 that is similar in quantity, type, and quality to that specified for this Project, and who 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. Supplier Responsibilities: Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Architectural Hardware Consultant Responsibilities:

a. Detailing, scheduling and ordering of finish hardware.
b. Meeting with Owner to finalize keying requirements and to obtain final instructions in writing.
c. Stock parts for products supplied and be capable of repairing and replacing hardware items found defective within warranty periods.

D. Door Inspector Qualifications: Inspector for field quality-control inspections shall comply with the following:

1. Fire Rated Door Assemblies: Comply with qualifications set forth in NFPA 80, Section 5.2.3.
2. Egress Door Assemblies: comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4.
3. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 CONFERENCES AND MEETINGS

A. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Conference participants shall include Owner's lock system representative, Supplier's Architectural Hardware Consultant Contractor, and Architect. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Attendees shall include Owner, Contractor, Architect, Project Inspector, Installer, and Supplier's Architectural Hardware Consultant. Review methods and procedures related to door hardware including, but not limited to, the following:

1. Hardware products and schedule.
2. Installation procedures and coordination required with related work.
3. Review Owner's keying standards.

1.8 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations 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, and chemicals.

D. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

E. Deliver permanent keys and cores directly from lock manufacturer to Owner's designated representative by secured delivery.

1.9 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Keying: Coordinate keying, and access control with Owner's lock hardware staff and/or consultant.

C. Review, compare, and coordinate scheduled hardware with doors, frames, and adjacent floor and wall conditions for non-compatible mounting and/or operating conditions; notify Architect in writing of any conflicts.

D. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm systems and similar control systems.

E. Aluminum Storefront Entrances: Coordinate hardware for aluminum entrance doors with hardware specified in this Section.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Established from date of Substantial Completion as follows:

a. Closers: Thirty (30) years.
b. Locksets: Three (3) years
c. All other hardware: Two (2) years.

1.11 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.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND REGULATORY REQUIREMENTS

A. Regulatory Requirements: Comply with the 2010 ADA Standards for Accessible Design, ANSI A117.1, and the 2019 California Building Code.

1. Opening Hardware, Mounting Height and Operation: Operable parts of door hardware shall be 34 inches minimum and 44 inches above the floor. Hand

activated door opening hardware shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist to operate; the force required to activate operable parts shall not exceed 5 lbs. Egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort. The unlatching of any door or leaf shall not require more than one operation (2019 CBC 11B-309.4 & 11B-404.2.7, 1010.1.9, 1010.1.9.6).

2. Closers, Opening Force: The opening force shall be the push/pull effort applied perpendicular to the face of the door at the operating hardware. Other than required fire rated doors, the effort to operate doors shall not exceed 5 pounds; the effort to operate required fire rated doors shall be the minimum force allowable by the appropriate administrative authority and shall not exceed 15 pounds (2019 CBC 11B-404.2.9).
3. Closers, Closing Sweep Period: The closing sweep period for doors shall be such that from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch (2019 CBC 11B-404.2.8.1).
4. Thresholds: The height differential between the tops of thresholds and adjacent floor or landing surfaces shall not be more than 1/2 inch; offsets exceeding 1/4 inch shall be beveled with a 2:1 (horizontal to vertical) maximum slope (2019 CBC 11B-404.2.5).
5. Smooth Door Surface: The bottom 10 inches of doors shall have a smooth, uninterrupted surface to allow the door to be opened by a wheel chair footrest without creating a trap or hazardous condition (2019 CBC 11B-404.2.10).

B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C. Provide proper latching hardware, door closers, approved-bearing hinges, and seals whether listed in the Hardware Schedule or not.

1. Where exit devices are indicated on fire-rated door assemblies, provide UL label on exit devices indicating "Fire Exit Hardware".

C. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

D. Electrified Door Hardware: Listed and labeled as defined in the California Electrical Code, by a qualified testing agency, and marked for intended location and application.

2.2 SCHEDULED DOOR HARDWARE

A. Scheduled Door Hardware: Door hardware sets are included in the Door Hardware Schedule at the end of this Section; provide door hardware for each door to comply with requirements in this Section and the Door Hardware Schedule. Manufacturer and product designations are listed for each door hardware item for the purpose of establishing minimum requirements. Subject to compliance with requirements, provide products indicated or comparable products by manufactures listed below:

HARDWARE TYPE	BASIS OF DESIGN MANUFACTURER	MANUFACTURERS OF COMPARABLE PRODUCTS
Butt Hinges	Ives	Hager, Stanley
Continuous Gear Hinges	Ives	Hager, Stanley
Lock/Latchsets, Cylinders, and Key System	Schlage	
Electronic Locks	Schlage Electronics	
Exit Devices	Von Duprin	
Overhead Stops	Glynn Johnson	
Closers	LCN	
Door Trim (Pulls, Plates, Bolts, Coordinators, Stops)	Ives	Trimco
Thresholds and Seals	Zero International	National Guard Products

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

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

2.3 DOOR HARDWARE PRODUCTS

A. General: Door hardware products shall comply with preceding "Performance and Regulatory Requirements" Article.

B. Butt Hinges: Full mortise, 3 or 5 knuckle ball bearing hinges with flat button tips, weight as indicated.

1. Size: As indicated in schedule, not less than 4.5 x 4.5 inches.
2. Material:

    a. Interior Fire Rated Openings: Steel hinge with steel pin.
    b. Interior Non-Fire Rated Openings: Steel or Brass hinge with steel pin.
    c. Exterior Doors: Stainless steel hinge with stainless steel pin, and with non-removable pins.

3. Quantity per Door Leaf:

    a. 2 hinges for doors with heights up to 60 inches.
    b. 3 hinges for doors with heights of 61 to 90 inches.
    c. 4 hinges for doors with heights of 91 to 120 inches.

C. Continuous Gear Hinges: Full mortise, heavy duty aluminum continuous gear hinge.

D. Lock and Latch Sets: Cylindrical or mortise latch/lock sets as scheduled with lever handled trim and as follows:

1. Lever Handles: Comply with requirements of SFM Standard 12-10-2, Section 12-10-202 contained in the CCR, Title 24, part 12, California Referenced Standards Code.
2. Breakaway Exterior Levers: Exterior doors shall be provided with independent security breakaway levers, breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
3. Backset: 2-3/4 inches unless otherwise indicated.
4. Mortise Locksets:

   a. Chassis: Cold-rolled steel, handing field-changeable without disassembly.
   b. Latchbolt and Deadbolt: 3/4 inch minimum latch throw, 1 inch minimum deadbolt throw, stainless steel anti-friction type.
   c. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
   d. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
   e. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction and lips of sufficient length to clear trim and protect clothing.
   f. Certifications:

      1) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
      2) ANSI/ASTM F476-84 Grade 31 UL listed.

E. Exit Devices: Surface mounted rim type exit devices as scheduled.

1. Certifiable by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 1994 standards.
2. Handing: Non-handed basic device design with center case interchangeable with all functions.
3. Fluid Damper Return: Devices shall have quiet return fluid dampeners.
4. Latchbolts: Latchbolts shall be deadlocking with ¾" throw and have a self-lubricating coating to reduce friction and wear.
5. Outside Trim: As scheduled; where operating levers are provided, provide manufacturer's standard "breakaway" feature for lever trim.
6. Strikes: All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
7. Fasteners: Exit Devices to be sex-bolted through doors.
8. Glazing Bead Kits: Furnish glass bead kits where required for doors with glazing.
9. Removable Mullions: Provide keyed removable mullions where indicated for pairs of doors with rim style exit devices.

F. Surface Closers: Fully adjustable full rack-and-pinion type cylinder with cast iron body and non-ferrous cover, heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring, and as follows:

1. ISO 2000 certified; units stamped with date-of-manufacture code.
2. Certifiable by independent testing laboratory that device has completed over 10,000,000 cycles and can still meet ANSI/BHMA A156.4

3. Non-sized, non-handed, and fully adjustable with separate adjusting valves for closing speed, latching speed, and backcheck; and with a fourth valve for delayed action where scheduled.
4. Arms and Mounting: Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated:

    a. Regular Arm: Pull side, door mounted, for doors swinging into rooms.
    b. Parallel Arm: Push side, door mounted, for doors swinging out of rooms.
    c. Provide extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
    d. Supplemental Brackets: Coordinate closer mounting requirements with other hardware items and provide supplemental mounting brackets where required for a complete installation.

5. Fluid: Closers shall utilize a stable fluid withstanding a temperature range of 120 degrees F to -30 degrees F without requiring seasonal adjustment of closer speed to properly close the door. Fluid shall be non-flaming and shall not fuel door or floor covering fires.
6. Fasteners: Closers to be sex-bolted through doors.

G. Door Bolts: For pairs of doors utilizing cylindrical or mortise locksets; provide bolts as scheduled and as follows:

1. Automatic Flush Bolts: Provide automatic flush bolts at pairs of doors from occupiable spaces. Utilize top bolt only models for interior doors where applicable and as permitted by testing procedures.
2. Manual Flush bolts: Provide manual flush bolts only when permitted on storage or mechanical room openings as scheduled.
3. Dust Proof Strikes: Provide dust proof strikes at openings using bottom bolts.
4. Coordinators: Provide coordinators at openings using automatic flush bolts.

H. Stops, Holders, and Bumpers: Provide units as scheduled; all doors shall be provided with a stop or bumper; stops and bumpers shall be mounted within 8 inches of the outside (strike) edge of the door and shall be not more than 4 inches from walls.

1. Overhead Stops: Provide surface mounted overhead stops where floor or wall stops, or closers with stops cannot be utilized.
2. Flip down door mounted stops shall not be allowed.

I. Protection Plates: Kick, armor, or mop plates, 0.050 inch thick stainless steel with four edges beveled, 2 inches less than door width; kick plates to be 10 inches high, mop and armor plate heights shall be as indicated.

J. Lock Protectors: Fabricated from stainless steel with internally threaded fasteners for flat head machine screws through bolted to door; hex head or carriage bolt fasteners will be permitted.

K. Thresholds: Aluminum and as detailed or scheduled; provide at all exterior doors.

L. Door Bottoms and Sweeps: Provide sweep seals at out swinging exterior doors unless other types are scheduled.

M. Seals: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated, scheduled, or required for smoke rated openings.

1. Resilient Seal Material: Polyurethane, polypropylene, nylon brush, silicone rubber or solid high-grade neoprene as scheduled. Vinyl seal material shall not be acceptable.
2. Intumescent Seals: Provide intumescent seals at fire rated openings where required by Code; comply with UL 10C.

N. 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.

2.4 KEYING

A. Existing System: Cyberlock key systems as specified. Available from owners' vendor:

1. Key Evidence 2343 W Whitendale Ave Visalia Ca 93277 559-733-3333.

B. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.

C. Temporary cylinders/cores remain supplier's property.

D. Furnish 10 construction keys.

E. Furnish 2 construction control keys.

2.5 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum

fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
        2) Strike plates to frames.
        3) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
5. 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.
6. Screws for butt hinges shall be flathead, countersunk, full-thread type.
7. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
8. Provide stainless steel expansion anchors for attaching hardware items to concrete or masonry.
9. All exit devices and lock protectors shall be fastened to the door by the means of sex bolts or through bolts.

2.6 FINISHES

A. Provide finishes as indicated in door hardware schedule and as follows:

1. Plated Steel and Brass: Satin chromium US26D (626) unless otherwise noted.
2. Stainless Steel: Satin stainless steel US32D (630) unless otherwise noted.
3. Door Closers: Powder-coated to match other hardware, unless otherwise noted.
4. Aluminum: Clear anodized aluminum US28 (628), except thresholds which can be furnished as standard mill finish.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

B. Use the templates provided by hardware item manufacturer.

C. Mounting Heights: Mount door hardware units at heights to comply with Performance and Regulatory Requirements Article and as follows:

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Operating hardware shall be located between 34 and 44 inches above the floor to comply with requirements of the 2019 California Building Code and the 2010 ADA Standards for Accessible Design.

D. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

E. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

G. Thresholds: Set thresholds for exterior doors in a full bed of butyl-rubber sealant, secure to concrete substrates with 1/4 inch diameter stainless steel flat head sleeve anchors equally spaced not more than 12 inches on center and not more than 3 inches from ends.

H. If hand of door is changed during construction, make necessary changes in hardware at no additional cost to the owner.

3.3 ADJUSTING

A. Initial Adjustment: Approximately 2 weeks prior to completion or occupancy, check each operating item of door hardware for each door to ensure proper operation or function; adjust operational hardware as needed for proper operation. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Adjust door latches and closers with heating and ventilating equipment fans in operation in order to compensate for room-to-room or room-to-exterior air pressure differences.
2. Door Closers: Adjust door closers so that the effort to operate doors shall not exceed a 5 pound force for non-fire rated doors; the force for fire rated doors shall be the minimum force allowable by the appropriate administrative authority and shall not exceed 15 pounds; the force shall be the push/pull effort applied at right angles to hinged doors (2019 CBC 11B-404.2.9). Adjust the sweep period for closers so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch (2019 CBC 11B-404.2.8.1).

B. Occupancy Adjustment and Service: Approximately six months after the completion of the project, the Contractor, accompanied by the Architectural Hardware Consultant, shall return to the project and check each operating item of door hardware and each door to ensure proper operation or function of every unit; re-adjust hardware items to restore proper functions. 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 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Supplier’s Architectural Hardware Consultant (AHC), with installer present, shall inspect and test installed door hardware operation with the building’s climate control system at rest and in full operation. Architectural Hardware Consultant shall certify that hardware has been furnished and installed in accordance with the Contract

Documents, manufacturer's instructions, as specified herein, and that door hardware operates as intended.

C. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

D. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

E. Prepare and submit separate inspection reports for each fire-rated door assemblies and egress door assemblies indicating compliance with each item listed in NFPA 80 and NFPA 101, Section 7.2.1.15.6.

F. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

G. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surface soiled by hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION AND TRAINING

A. Instruct Owner's Personnel to adjust, operate, and maintain door hardware and door hardware finishes during the final adjustment of hardware.

3.7 DOOR HARDWARE SETS

A. The items listed in the following Hardware Sets shall conform to the requirements of the foregoing specifications.

B. The Door Schedule on the Drawings indicates hardware sets for each door.

C. Abbreviations for Manufacturers:

GJ	=	Glyyn-Johnson	Overhead stops, coordinators
CYB	=	Cyberlock	Access Control System
IVE	=	Ives	Hinges, Door trim, bolts, plates
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders

SCE	=	Schlage Electronics	Electronic Locks
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Applied Jamb Stops

D. Door Hardware Sets:

HW SET: 01

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9080BDC 06A	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 02

4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9480BDC 06A L583-363	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 03

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9080BDC 06A	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401CCV	626	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 04

4	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	ENTRANCE LOCK	L9453BDC 06A L583-363	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401CCV	626	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 05

4	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	ELECTRONIC LOCK	CO-200-MS-40-KP-RHO-BD	626	SCE
1	EA	SURFACE CLOSER	4041XPT (TOP JAMB MOUNT)	689	LCN
1	EA	MOUNTING PLATE	4040TXP-18TJ	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 06

4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	MORTISE DEADBOLT	L463BDC XB11-720	626	SCH
1	EA	PUSH PLATE	8200 8" X 16" CFC	630	IVE
1	EA	PULL PLATE	8302-8 4" X 16" CFC	630	IVE
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 07

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	OFFICE LOCK	L9056BDC 06A X L583-363	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401CCV	626	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 08

1	EA	CONTINUOUS HINGE	112XY	628	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	OFFICE LOCK	L9056BDC 06A X L583-363	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

PERIMETER SEALS BY DOOR MANUFACTURER

HW SET: 09

4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9480BDC 06A L583-363	626	SCH
1	EA	SURFACE CLOSER	4041XP-H-EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 10

4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9480BDC 06A L583-363	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 11

4	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	ENTRANCE LOCK	L9453BDC 06A L583-363	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401CCV	626	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 12

4	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	OFFICE LOCK	L9056BDC 06A X L583-363	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401CCV	626	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 13

4	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9080BDC 06A	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 14

4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	AXCD99NL X 990NL-PA	626	VON
2	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	RIM CYLINDER	80-159	626	SCH
1	EA	THUMBTURN	ADA7201 (FOR DOGGING)	626	ILC
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 15

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	OFFICE LOCK	L9056BDC 06A X L583-363	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 16

4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	AXCD99NL X 990NL-PA	626	VON
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	RIM CYLINDER	80-159	626	SCH
1	EA	THUMBTURN	ADA7201 (FOR DOGGING)	626	ILC
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 17

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9080BDC 06A	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 18

2	EA	CONTINUOUS HINGE	112XY	628	IVE
2	EA	PULL/PUSHBAR	9190HD-0	630	IVE
2	EA	SURFACE CLOSER	4041XP-H-EDA	689	LCN
2	EA	DOME STOP	FS438 435 436 437 AS REQU'D	626	IVE

HW SET: 19

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	OFFICE LOCK	L9056BDC 06A X L583-363	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401CCV	626	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER

HW SET: 20

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9480BDC 06A L583-363	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 21

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	STOREROOM LOCK	L9080BDC 06A	626	SCH
1	EA	OVERHEAD HOLDER	410F	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 22

12	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
4	EA	MANUAL FLUSH BOLT	FB457	626	IVE
2	EA	DEADBOLT	B660BDC	626	SCH
2	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
4	EA	DOOR PULL	8111-5	626	IVE
2	EA		ASTRAGAL BY DOOR MANUFACTURER		
4	EA	DOOR HOLDER	PAH60	689	LCN
2	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
4	EA	AUTO DOOR BOTTOM	351	AL	ZER
4	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	548A MSLA-10	AL	ZER

HW SET: 23

4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	AXCD99NL X 990NL-PA	626	VON
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	RIM CYLINDER	80-159	626	SCH
1	EA	THUMBTURN	ADA7201 (FOR DOGGING)	626	ILC
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 24

1	EA	CONTINUOUS HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	AXCD99NL X 990NL-PA	626	VON
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	RIM CYLINDER	80-159	626	SCH
1	EA	THUMBTURN	ADA7201 (FOR DOGGING)	626	ILC
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	SECURITY FLOOR STOP	FS18S	BLK	IVE
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

PERIMETER SEALS BY DOOR MANUFACTURER

HW SET: 25

4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	AXLD99L 996L-PA	626	VON
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4041XP-H-EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 26

4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	AXLD99L 996L-PA	626	VON
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	RIM CYLINDER	80-159	626	SCH
1	EA	SURFACE CLOSER	4041XP EDA	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

HW SET: 27

4	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	CYBERLOCK CORE	CL-SF-03	626	CYB
1	EA	PRIVACY LOCK W/ IND.	L9496BDC X 06A X L583-373	626	SCH
1	EA	SURFACE CLOSER	4041XPT (TOP JAMB MOUNT)	689	LCN
1	EA	MOUNTING PLATE	4040TXP-18TJ	689	LCN
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	SET	SEALS	188S HEAD AND JAMBS	BLK	ZER
1	EA	DOOR SWEEP	39A	AL	ZER
1	EA	THRESHOLD	103A MSLA-10	AL	ZER

END OF SECTION

SECTION 088000
GLAZING

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. Glass for windows, doors, and curtain wall framing including the following:

   a. Glass products.
   b. Insulating glass units.
   c. Laminated glass.
   d. Miscellaneous glazing materials.

2. Glass Types are indicated in glass type schedules at the end of this Section.

B. Related Sections include the following:

1. Division 08 Section "Translucent Wall Assemblies" for translucent glazing.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 SUBMITTALS

A. Product Data: For each type of product; include statement of VOC content for any adhesives or sealants.

B. Glass Samples: For each type of tinted insulating glass in minimum 12-inch square samples.

C. Glazing Accessory Samples: For sealants and colored spacers in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in installations with a record of successful in-service performance; and who employs glass installers for this Project who are experienced in installing glazing similar in material, design, and extent to that indicated for this Project.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.6 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Where products are identified by manufacturer and product names, Design, Drawings, and Specifications are based on the product indicated; subject to compliance with requirements, provide the named product or a comparable product by one of the following:

   1. Guardian Industries.
   2. Oldcastle Building Envelope.
   3. Pilkington Building Products North America.
   4. Vitro Architectural Glass (Formerly PPG Industries, Inc.)
   5. Viracon, Inc.

B. Source Limitations for Glass: Obtain glass, tinted glass, and coated glass products from a single source from a single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain accessories from a single source from a single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. California Code of Regulations, Title 24, Part 6, California Energy Code.

1. NFRC 100: Procedure for Determining Fenestration Product U-factors."
2. NFRC 200 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence."
3. NFRC 400: Procedure for Determining Fenestration Product Air Leakage."

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the California Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 7 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Identification: Where safety glazing is indicated, each pane of safety glazing shall be identified by a manufacturer's designation specifying who applied the designation, the manufacturer or installer and the safety glazing standard with which it complies, as well as the information specified in CBC Section 2403.1. The designation shall be acid etched, sand blasted, ceramic fired, laser etched, embossed, or of a type that once applied cannot be removed without being destroyed. A label meeting the requirements of CBC Section 2406.3 shall be permitted in lieu of the manufacturer's designation.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary seals.
2. Spacer: Manufacturer's standard spacer material and construction, aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in Part 3 Article "Insulating Glass Schedule."

1. Provide Kind HS (Heat-strengthened) or Kind FT (Fully tempered) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

2.7 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: Field applied sealants shall have a VOC content of not more than 250 g/L.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Tremco Incorporated; Spectrem 1.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Type recommended by sealant or glass manufacturer; EPDM, Silicone, Neoprene, or Santoprene; with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Type recommended by sealant or glass manufacturer; neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Type recommended by sealant or glass manufacturer; EPDM, Silicone, Neoprene, or Santoprene; with a Shore A durometer hardness per manufacturer's written instructions.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lights.

F. Provide spacers for glass lights where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until immediately before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending

stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lights and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type GMC: Clear float glass.

1. Thickness: 6.0 mm.

B. Glass Type GMCT: Clear fully tempered float glass.

1. Thickness: 6.0 mm.
2. Safety glazing required.

C. Glass Type GMTT: Tinted fully tempered float glass.

1. Basis of Design: Vitro; Solarban 70.
2. Tint Color: Neutral.
3. Thickness: 6.0 mm.
4. Safety glazing required.

3.9 INSULATING-GLASS SCHEDULE

A. Glass Type GIC: Low-e coated, clear insulating glass.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear annealed float glass.
4. Indoor Lite: Clear annealed float glass.
5. Interspace Content: Clean-Dry-Air.
6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Visible transmittance: 62 Percent
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Solar Heat Gain Coefficient: 0.27.

B. Glass Type GICT: Low-e coated, clear, fully tempered insulating glass.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear, fully tempered float glass.
4. Indoor Lite: Clear, fully tempered float glass.
5. Interspace Content: Clean-Dry-Air.
6. Low-E Coating: Pyrolytic or sputtered on second surface.
7. Visible transmittance: 62 Percent
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: #### maximum.
10. Solar Heat Gain Coefficient: 0.27.
11. Provide safety glazing labeling.

C. Glass Type GIT: Low-e coated, tinted insulating glass.

1. Basis of Design: Drawings and Specifications are based on the following:

   a. Vitro; Solarban 70.

2. Overall Unit Thickness: 1-inch (25mm).
3. Minimum Thickness of Each Glass Lite: 6.0 mm.
4. Outdoor Lite: Tinted heat strengthened float glass.
5. Indoor Lite: Clear heat strengthened float glass.
6. Interspace Content: Clean-Dry-Air.
7. Low-E Coating: Pyrolytic or sputtered on second surface.
8. Visible transmittance: 64 Percent
9. Winter Nighttime U-Factor: 0.28 maximum Btu/h ft^2 F.
10. Solar Heat Gain Coefficient: 0.27.

11. Shading Coefficient: 0.32.
12. Light to Solar Gain: 2.37.

D. Glass Type GITT: Low-e coated, tinted, tempered insulating glass.

1. Basis of Design: Drawings and Specifications are based on the following:

a. Vitro; Solarban 70.

2. Overall Unit Thickness: 1-inch (25mm).
3. Minimum Thickness of Each Glass Lite: 6.0 mm.
4. Outdoor Lite: Tinted fully tempered float glass.
5. Indoor Lite: Clear fully tempered float glass.
6. Interspace Content: Clean-Dry-Air.
7. Low-E Coating: Pyrolytic or sputtered on second surface.
8. Visible transmittance: 64 Percent
9. Winter Nighttime U-Factor: 0.28 maximum Btu/h ft^2 F.
10. Solar Heat Gain Coefficient: 0.27.
11. Shading Coefficient: 0.32.
12. Light to Solar Gain: 2.37.

3.10 LAMINATED-GLASS SCHEDULE

A. Glass Type GMLT: Clear laminated glass with two plies of fully tempered float glass.

1. Thickness of Each Glass Ply: 6.0 mm.
2. Interlayer Thickness: 0.030 inch.
3. Safety glazing required.

END OF SECTION

SECTION 092216
NON-STRUCTURAL METAL FRAMING

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. Non-Structural, non-load-bearing steel framing for standard interior non-load-bearing, metal-stud framing within height limitations.

B. Related Sections:

1. Division 03 Section “Post Installed Concrete Anchors” for anchors in concrete and/or masonry.
2. Division 05 Section "Cold-Formed Metal Framing" for metal framing for exterior walls and interior load bearing conditions.
3. Division 09 Section “Gypsum Board” for gypsum board attached to steel framing systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer’s written installation procedures and details.

1. Provide documentation that stud and track members are certified in accordance with the product certification program of the Steel Framing Industry Association (SFIA) or a similar organization that provides a verifiable code compliance program.

B. Evaluation Reports: From ICC-ES or IAPMO ES, or certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria, for the following:

1. Metal framing.
2. Post installed concrete anchors.
3. Powder-actuated fasteners.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Use adequate number of skilled workmen who are thoroughly trained and experienced in the installation of non-structural metal framing and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect non-structural metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing." Cover stored metal framing with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 MANUFACTURERS

A. Source Limitations: Obtain metal framing systems for a single source from a single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide non-structural metal framing by one of the following:

1. California Expanded Metal Products Company.
2. ClarkDietrich.
3. MarinoWare; a Division of Ware Industries.
4. SCAFCO Corp.

2.3 NON-LOAD-BEARING STEEL FRAMING SYSTEMS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Framing Members General: Comply with AISI S220 and ASTM C 645, Section 10 and Steel Stud Manufacturers Association (SSMA), Product Technical Information, ESR-4064P, or the Steel Framing Industry Association (SFIA) Technical Guide for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal, unless otherwise indicated.
2. Protective Coating: Comply with AISI S220, ASTM A653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

C. Steel Studs, Joists, and Track: AISI S220 and ASTM C 645, Section 10, of minimum base metal thickness and size as indicated on the Drawings.

1. Joists shall be un-punched.

D. Slip-Type Head Joints: Slip type head joints shall be as indicated on Drawings, where not indicated on Drawings, provide one of the following:

1. Single Long-Leg Track System: ASTM C645 top track with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs. Subject to compliance with requirements, provide one of the following:

   a. Dietrich Metal Framing; SLP-TRK.
   b. Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
   c. Superior Metal Trim; Superior Flex Track System (SFT).

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Subject to compliance with requirements, provide one of the following:

1. Dietrich Metal Framing; SLP-TRK.
2. Fire Trak Corp.; Fire Trak
3. Metal-Lite, Inc.; The System.

F. Backing Plate: Steel sheet for blocking and bracing in size and thickness indicated on Drawings, 0.0312-inch thick (20 gauge) minimum.

G. Flat Strapping: 1-1/2 inch wide by 0.0296-inch thick (20 gauge) flat steel strapping unless otherwise indicated on Drawings.

H. Cold-Rolled Channels for Bridging and Furring: Steel, 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.

1. Depth: 3/4-inch or 1-1/2-inch as required for project conditions, otherwise indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.0538-inch thick, galvanized steel.

I. Hat-Shaped, Rigid Furring Channels: AISI S220 of size and metal thickness as indicated on the Drawings, 0.0312-inch thick (20 gauge) minimum thickness.

J. Resilient Furring Channels: 1/2-inch deep, asymmetrical shaped, steel sheet members designed to reduce sound transmission.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

B. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten steel members to substrates.

C. Post Installed Concrete Anchors: Fabricated from corrosion-resistant materials; manufacturer, size, and type as indicated on Drawings and specified in Division 03 Section “Post Installed Concrete Anchors.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 INSTALLATION OF FRAMING

A. Install framing components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated. Comply with the following installation standards:

1. ASTM C754.
2. ASTM C 840 as applicable to metal framing systems for gypsum board.
3. ICC or IAPMO Engineering Report for metal framing system.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

F. Install studs and joists so flanges within framing system point in same direction.

G. Install tracks at floors and tops of walls as indicated on Drawings.

1. Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies. Provide slip-type head joints as indicated on the Drawings, or if not indicated, by one of the following methods:

a. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
b. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, outside runner fastened to overhead structure and sized to friction fit inside runner with not less than 1 inch overlap of flanges and providing not less than 1 inch vertical deflection.
c. Deflection type top track.

H. Door Openings: Frame door openings as indicated on Drawings; install not less than two studs at each jamb, unless otherwise indicated. Extend jamb studs to the structure above, where jamb studs do not extend to the structure above, provide diagonal bracing perpendicular to the wall and located directly above jamb studs and fasten bracing to the structure above. Screw vertical studs at jambs to jamb anchor clips on door frames.

I. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

J. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure. Frame top of wall condition as indicated on Drawings to maintain continuity of fire-resistance-rated assembly indicated.

K. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

L. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION

SECTION 092400
PORTLAND CEMENT PLASTERING

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. Exterior portland cement plasterwork (stucco) with acrylic finish, including lath and accessories installed over rigid foam board insulation. Portland cement plastering system to be as described by plaster wall assembly PWA 104 in the “Energy Code and Plaster Assemblies” brochure published by the Technical Services Information Bureau (TSIB), the Northwest Wall and Ceiling Bureau (NWCB), and the Wall and Ceiling Bureau (WCB); cement plastering system includes the following:

   a. Lath.
   b. Cement plaster scratch and brown coats.
   c. Lamina base coat of acrylic modified cement skim coat embedded in fiber mesh applied over the cement plaster brown coat.
   d. Acrylic finish coat.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for exterior steel studs and joists that support lath and portland cement plaster.
2. Division 06 Section "Exterior Gypsum Sheathing" for exterior gypsum sheathing.
3. Division 07 Section "Blanket Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.
4. Division 07 Section "Weather Resistive Barriers" for building wrap and flexible flashing included in portland cement plaster assemblies.
5. Division 07 Section “Thermal Foam Plastic Wall Insulation” for foam plastic board insulation that is a wall substrate for cement plastering.
6. Division 07 Section “Sheet Metal Flashing and Trim” for sheet metal items installed in conjunction with cement plaster assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated and/or included in the Work.

B. Samples for Initial Selection: For each type and color of factory-prepared finish coat indicated.

C. Samples for Verification: For each texture and color of finish coat indicated; 36 by 36 inches and prepared on rigid backing.

D. Research/Evaluation Reports: From ICC-ES or IAPMO ES, for metal lath.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups of area directed by Architect to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Mockups shall include and demonstrate the installation and/or finish of the following:

   a. Weather resistive barrier and flexible flashing at door and window openings.
   b. Sheet metal flashing and trim at door and window openings.
   c. Lath and accessories.
   d. Terminations and transitions to other surfaces and materials.
   e. Cement plastering.

2. Contractor shall coordinate mockups requiring multiple trades.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Owner's Project Inspector, Architect, and installers whose work interfaces with or affects exterior wall systems, work trades include but are not limited to the following:

   a. Wall Framing.
   b. Wall sheathing.
   c. Weather resistive barriers.
   d. Rigid wall insulation.
   e. Flashing.
   f. Portland cement plastering.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review and coordinate installation requirements and installation schedule for each trade.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 COORDINATION

A. Coordinate plaster work with work of the following Sections:

1. Division 05 Section "Cold-Formed Metal Framing".
2. Division 06 Section "Exterior Gypsum Sheathing".
3. Division 07 Section "Weather Resistive Barriers".
4. Division 07 Section “Thermal Foam Plastic Wall Insulation”.
5. Division 07 Section “Sheet Metal Flashing and Trim”.
6. Division 08 Sections as applicable to door and window openings adjacent to cement plaster work.

1.8 FIELD CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Basis of Design: Where Basis of Design named manufacturer products are indicated, Design, Drawings, and Specifications are based on products by the following:

1. The Structa Wire Corporation.

a. Subject to compliance with requirements, provide products indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”

B. Welded Wire-Fabric Lath for Walls:

1. Basis of Design: Design and details are based on the following:

   a. Structa Wire Corporation; Megalath (IAPMO UES ER 2017).

2. Self-furred welded wire fabric lath without paper backing and as follows for use over solid sheathed vertical surfaces.

   a. Size: 30 inch by 108 ft. roll.
   b. Wire Spacing: 1.5 inch by 0.7 inch rectangular grid.
   c. Wire: Hot-dipped galvanized, low-carbon, cold-drawn steel wire complying with ASTM A641-2, Class 1.

      1) Longitudinal (Horizontal) Wires: Wire flattened to dimensions of 0.033 inches by 0.075 inches by cold rolling.
      2) Cross (Vertical) Wires: 0.56 inch diameter wire having 1/4 inch high furring crimps spaced 2.125 inches on center.

   d. Welding: Each intersection of longitudinal and cross wires shall be electrical resistance welded.
   e. Self-Furring: 1/4 inch minimum.
   f. Nominal weight of Lath: 1.95 lb/sq. yd.

C. Welded Wire-Fabric Lath for Ceilings:

1. Basis of Design: Design and details are based on the following:

   a. Structa Wire Corporation; VTruss Ceiling Lath (ICC # ESR 2017).

2. Self-furred welded wire fabric lath sheets with vented kraft paper backing and as follows for use over horizontal surfaces.

   a. Sheet Size: 97.5 inches by 28.375 inches.
   b. Wire Spacing: 1.5 inch by 0.7 inch rectangular grid.
   c. Wire: Hot-dipped galvanized, low-carbon, cold-drawn steel wire complying with ASTM A641-2, Class 1.

      1) Longitudinal (Horizontal) Wires: Wire flattened to dimensions of 0.033 inches by 0.064 inches by cold rolling.
      2) Cross Wires: 0.05 inch diameter with 3/8 inch high furring crimps spaced 1.9 inches on center.
      3) Backing Wires: Coated diameter of 0.050 inch in a longitudinal direction to the furring crimps.

   d. Welding: Each intersection of longitudinal and cross wires shall be electrical resistance welded.
   e. Self-Furring: 3/8 inch minimum.
   f. Nominal weight of Lath: 2.2 lb/sq. yd.

D. Corner Reinforcement:

1. Basis of Design: Design and details are based on the following:

a. Structa Wire Corporation; VTruss Straight Corner (ICC # ESR 2017).

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
b. CEMCO.
c. Clark Dietrich Building Systems.
d. MarinoWARE.
e. Stockton Products.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.
3. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
4. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
5. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
6. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch wide; with perforated flanges.
7. Reveals: Fabricated from zinc-coated (galvanized) steel of configuration indicated on Drawings.

C. Aluminum Trim: Extruded aluminum trim accessories of profiles and dimensions indicated on Drawings.

1. Basis of Design Manufacturer: Design and details are based on products manufactured by:

a. The Fry Reglet Corporation.

1) Subject to compliance with requirements, provide products indicated or equivalent products by one of the following:

a) Gordon, Inc.
b) Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Class II clear anodic finish.

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

C. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

D. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

E. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

C. Sand Aggregate: ASTM C 897.

D. Reinforcing Mesh: Alkali resistant glass fiber reinforcing mesh, 4 oz. to 6 oz./sq. yd.

E. Polymer cement (Lamina skim coat).

F. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. Parex, Inc., E-Lastic.

1) Products: Subject to compliance with requirements, provide one of the following:

a) Dryvit Systems, Inc.; Dryvit TAFS.
b) El Rey Stucco Company, Inc., a brand of ParexLaHabra, Inc.; Prema-Flex.

c) LaHabra, a brand of ParexLaHabra, Inc.; Acrylic Finish.
d) Omega Products International, Inc.; Omega Flex Finishes.
e) Senergy, BASF Wall Systems, Inc.; Senerflex.
f) Sto Corp.; Powerwall Finish.
g) Surewall, a brand of ParexLaHabra, Inc.; Acrylic Finish.
h) SonoWall, BASF Wall Systems, Inc.; StuccoTex Finish.

2. Color: As selected by Architect from manufacturer's full range.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. Base Coat Mixes:

1. Scratch and brown coats for three-coat plasterwork for use over metal lath:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime; use 2-1/2 to 4 parts sand per part of cementitious material.

b. Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime; use 3 to 5 parts sand per part of cementitious material, but not less than the volume of sand used in the scratch coat.

C. Polymer Cement (Lamina skim coat): Comply with manufacturer's written instructions.

D. Factory-Prepared Acrylic Finish-Coat Mixes: Comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

C. Inspect insulation substrate for effects of weathering. Boards that have 'yellowed' shall be scrubbed to remove UV-degradation and expose a clean surface or removed and replaced.

3.3 INSTALLING METAL LATH

A. Metal Lath: Install according to ASTM C 1063, lath manufacturer's written installation instructions, and as follows:

1. Lath shall be installed over rigid insulation as specified in Division 07 Section "Thermal Foam Plastic Board Wall Insulation."
2. Lath shall be installed with the long dimension perpendicular to supports.
3. Lath shall be fastened to framing members through the rigid insulation and sheathing. Lath shall be fastened to each framing member with not less than No. 10 screws spaced not more than 7 inches on center, fasteners shall have not less than required minimum penetration into framing members.
4. Self-furred lath shall be held out at 1/4 inch minimum from wall substrates and 3/8 inch minimum from ceiling substrates.

    a. Self-furred lath installation shall be subject to a satisfactory jobsite demonstration with approval by the Architect, the Project Inspector, and the DSA Field Engineer (Per DSA IR 25-4).

3.4 INSTALLING TRIM ACCESSORIES

A. Install according to ASTM C 1063, at locations indicated on Drawings, and as follows:

1. VTruss Corner Reinforcement: Use at outside corners.
2. Double-V Control Joint (#30): Use at interior corners.
3. Cornerite: Use at interior corners.
4. Casing Bead: Use at exposed edges, perimeters of doors, windows, and similar openings, and where indicated on drawings.
5. Foundation Weep Screed: Use at base of walls at grade; weep screeds shall be not less than 2 inches above paved surfaces and 4 inches above earth.
6. Drip Screed: Use at soffit edges.
7. Expansion Joints, Reveals, and Aluminum Trim: Use at locations indicated on Drawings.
8. Control Joints: Unless otherwise indicated on Drawings, provide control joints at locations approved by Architect for visual effect as follows:

    a. Where control joints occur in surface of construction directly behind plaster.

b. At corners of openings and where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
c. As required to delineate plasterwork into areas (panels) complying with the following:

1) Maximum length-to-width ratio: 2-1/2:1.
2) Maximum Joint Spacing: 18 feet o.c.
3) Maximum Area of Vertical Surfaces: 144 sq. ft.
4) Maximum area of Horizontal Surfaces: 100 sq. ft.

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Scratch and Brown Coat Thickness: Apply scratch and brown coats over metal lath for three-coat plasterwork to the following thicknesses:

1. Walls: 3/4 inch thickness.
2. Ceilings: 5/8 inch thickness.

C. Scratch Coat: Apply scratch coat as follows:

1. Apply continuously from architectural break to architectural break with sufficient pressure to ensure keying into lath; cold joints shall not be allowed.
2. Apply in sufficient thickness to substantially cover the lath.
3. Immediately score (scarify) in a predominately horizontal direction.
4. Wipe down all corners and trim accessories and leave no cement protrusions that will interfere with application of brown coat.
5. Place “butterflies” in a diagonal direction delicately onto fresh scratch coat at the apex of window and door penetrations.
6. Keep scratch coat hydrated for a period of 48 hours, follow ASTM and/or TSIB recommendations for curing.
7. Do not apply Brown coat until scratch coat is firm and hard.

D. Brown Coat: Apply brown coat as follows:

1. Pre-wet the scratch coat to avoid excessive suction of moisture from brown coat to avoid accelerated evaporation.
2. Apply continuously from architectural break to architectural break; cold joints will not be allowed.

3. Brown coat shall be applied and filled to the accessory trim grounds, surface to be immediately darbied and/or rodded to a level and plumb plane.
4. When the initial moisture has left brown coat, “hard” float the brown coat to densify, consolidate and prepare for a finish coat. Sponge floats are not acceptable. A hard float shall be considered made from wood shingle, cork, plastic, compact felt or neoprene.

E. Lamina Reinforcement Coat: Apply lamina reinforcement coat of fiberglass mesh and skim coat of polymer cement over brown coat; allow brown coat to cure a minimum of 5 days before applying lamina reinforcement coat.

F. Acrylic-Based Finish Coat: Apply acrylic based finish coat, including primers, over lamina reinforcement coat according to manufacturer's written instructions.

G. Concealed Exterior Plasterwork: Omit finish coat where plaster will be used as a base for adhered finishes.

3.6 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 092900
GYPSUM BOARD

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. Interior gypsum board.
2. Cementitious tile backing panels.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
2. Division 06 Section "Exterior Gypsum Sheathing" for exterior gypsum sheathing.
3. Division 07 Section "Blanket Insulation" for batt and blanket insulation installed in assemblies that incorporate gypsum board.
4. Division 09 Section "Non-Structural Metal Framing" for non-structural framing that supports gypsum board.
5. Division 09 Section “Painting” for primers applied to gypsum board surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s product data for each type of product indicated or incorporated into the Work.

1. Include statement of VOC content for any adhesives or sealants.

B. Samples for Verification: For the following:

1. Textured Finishes: Three (3) 48 inch square samples for each textured finish indicated and on same backing indicated for Work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

1. Width: 4 feet.
2. Length: 8, 10, or 12 feet.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum Co.
2. Georgia-Pacific Gypsum, LLC.
3. Lafarge North America Inc.
4. National Gypsum Company.
5. PABCO Gypsum.
6. USG Corporation.

B. Interior Gypsum Wallboard: ASTM C 1396/C 1396M of the following types:

1. Type X:

   a. Thickness: 5/8 inch.
   b. Long Edges: Tapered.

2. Moisture and Mold-Resistant Type: With moisture and mold-resistant core and surfaces.

   a. Core: 5/8 inch, Type X.
   b. Long Edges: Tapered.
   c. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corp.; FiberCement BackerBoard.
   b. Custom Building Products; Wonderboard.
   c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   d. James Hardie Building Products, Inc.; Hardiebacker.
   e. National Gypsum Company, Permabase Cement Board.
   f. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes: As required for project conditions, including but not limited to the following:

   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. L-Bead: L-shaped; exposed long flange receives joint compound.
   d. U-Bead: J-shaped; exposed short flange does not receive joint compound.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick (20 gage structural and heavier).
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Insulation: As specified in Division 07 Section "Blanket Insulation."

2.8 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

1. Coordinate primers with Division 09 Section “Painting.”

B. Finish: Pre-mixed, texture finish for spray application, texture as follows:

1. Toilet Rooms: Orange peel.
2. Classrooms and Office Spaces: Spatter knock down.
3. Shops, Storage, and Utility Rooms: Spatter knock down.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING GYPSUM PANELS, GENERAL

A. Comply with ASTM C 840 and manufacturer’s written installation instructions.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8-inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Fastening Gypsum Board Panels: Comply with fastening requirements of ASTM C 840 unless more stringent fastening requirements are required for fire resistance rated gypsum board assemblies as indicated on Drawings. Fasten gypsum panels to supports with steel drill screws as follows:

1. Fastener Spacing, Single Layer Gypsum Board Application:

a. Ceilings: Space fasteners 12 inches on center maximum.
b. Walls: Space fasteners 12 inches on center maximum where studs are spaced 24 inches on center; fastener spacing may be increased to 16 inches on center where studs are spaced 16 inches on center.
c. Edge Distance: Space fasteners 3/8 inches minimum from panel edges.

2. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
3. Where gypsum panels are installed over structural sheathing or acoustical board panels, increase the length of fasteners an amount equal to not less than the thickness of the sheathing or panels.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Coordinate gypsum panel installation with insulation work specified in Division 07 Section “Blanket Insulation.”

1. Thermal and sound attenuation batt/blanket insulation shall be installed before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side of framing members.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assemblies.
3. Moisture and Mold-Resistant Type: At walls of toilet and janitor rooms, walls within 2 feet (horizontally) of plumbing fixtures, and other locations as indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) using continuous panels without abutting end joints unless otherwise indicated or required by fire-resistance-rated design.

   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   b. At stairwells and other high walls where the vertical dimension of the wall without horizontal offsets exceeds the maximum available panel length, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated design.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, provide panels of matching thickness or shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use at exposed panel edges where LC-Bead cannot be used.
4. U-Bead: Use where indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840 and the Gypsum Association:

1. Level 1: All joints and interior angles shall have tape embedded in joint compound; surface shall be free of excess joint compound; tool marks and ridges are acceptable.

   a. Locations: Concealed areas and areas above ceilings.

2. Level 2: All joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over all joints, angles, fastener heads, and accessories; surface shall be free of excess joint compound; tool marks and ridges are acceptable.

   a. Locations: Panels that are substrate for applied rigid panels having a thickness not less than 3/8 inches.

3. Level 3: All joints and interior angles shall have tape embedded in joint compound and two (2) separate coats of joint compound applied over all joints, angles, fastener heads, and accessories; all joint compound shall be smooth and free of tool marks and ridges.

   a. Locations: Not used unless otherwise indicated on Drawings.

4. Level 4: All joints and interior angles shall have tape embedded in joint compound and Three (3) separate coats of joint compound applied over all joints, angles, fastener heads, and accessories; all joint compound shall be smooth and free of tool marks and ridges.

    a. Locations: At panel surfaces that will be exposed to view and painted or will be substrates for wall coverings.
    b. Primer and its application to surfaces are specified in Division 09 Section “Painting.”
    c. Where suspended ceilings are to be installed, wall finish shall extend not less than 6 inches above the ceiling height.

5. Level 5: All joints and interior angles shall have tape embedded in joint compound and Three (3) separate coats of joint compound applied over all joints, angles, fastener heads, and accessories; a thin skim coat of joint compound or similar material specific for this purpose shall be applied to the entire surface; the surface shall be smooth and free of tool marks and ridges.

    a. Locations: Not used unless otherwise indicated on Drawings
    b. Primer and its application to surfaces are specified in Division 09 Section “Painting.”

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes prior to application of finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

FOR BID ONLY

SECTION 093000
TILING

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. Ceramic tile.
2. Crack isolation membrane.
3. Metal trim.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile floor substrates.
2. Division 07 Section “Joint Sealants” for sealing of expansion, contraction, and isolation joints in tile surfaces.
3. Division 09 Section "Gypsum Board" for cementitious tile backing panels.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. 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 "American National Standard Specifications for Installation of Ceramic Tile."

1.4 SUBMITTALS

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

B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain all tile of same type from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Crack isolation membrane.
2. Joint sealants.
3. Metal trim.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Colors, Textures, and Patterns: Where selection of colors, surface textures, patterns, and other appearance characteristics are required, selections shall be made by Architect from manufacturer's full range unless otherwise indicated.

2.3 TILE PRODUCTS

A. Basis-of-Design Manufacturer: Where named products are indicated, design, Drawings, and Specifications are based on products manufactured by the following:

1. Dal-Tile International Corporation.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) Crossville Ceramics Company, L.P.
2) Florida Tile Industries, Inc.
3) Interceramic Tile.
4) Summitville Tiles, Inc.
5) United States Ceramic Tile Company.

B. Floor Tile, CT-1:

1. Product: Daltile, ‘Chord’ Colorbody Porcelain.
2. Size: Nominal 12 x 24 inches.
3. Thickness: 5/16 inch.
4. Surface: Smooth.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Finish: Mat, opaque.
7. Tile Color and Pattern: As indicated on Drawings or if not indicated, as selected by Architect.
8. Grout Color: As selected by Architect.

C. Wall Tile, CT-2:

1. Product: Daltile, ‘Chord’ Colorbody Porcelain.
2. Size: Nominal 24 x 48 inches.
3. Thickness: 5/16 inch.
4. Surface: Smooth.
5. Finish: Mat, opaque.
6. Tile Color and Pattern: As indicated on Drawings or if not indicated, as selected by Architect.
7. Grout Color: As selected by Architect.

D. Wall Tile, CT-3 (Accent):

1. Product: Daltile, ‘Chord’ Colorbody Porcelain.
2. Size: Nominal 12 x 24 inches.
3. Thickness: 5/16 inch.
4. Surface: Smooth.
5. Finish: Mat, opaque.
6. Tile Color and Pattern: As indicated on Drawings or if not indicated, as selected by Architect.
7. Grout Color: As selected by Architect.

2.4 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product, selected from the following that complies with ANSI A118.12 for high performance crack isolation membranes, and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

1. Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric, 0.030-inch nominal thickness.

   a. Available Products:

      1) Noble Company (The); Nobleseal TS.
      2) Noble Company (The); Nobleseal CIS.

2. PVC Sheet: PVC sheet heat-fused on both sides to facings of nonwoven polyester; 0.040-inch nominal thickness.

   a. Available Product: Compotite Corporation; Composeal Gold.

3. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.

   a. Available Product: Schluter Systems L.P.; KERDI.

4. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

   a. Subject to compliance with requirements, provide one of the following (Waterproof and/or crack isolation membrane):

      1) Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
      2) Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
      3) MAPEI Corporation; Mapelastic L (PRP M19).
      4) Mer-Kote Products, Inc.; Hydro-Guard 2000.
      5) Summitville Tiles, Inc.; S-9000.

2.5 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Modified Dry-Set Mortar (Thin Set): ANSI A118.4.

1. Prepackaged dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

   a. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Boiardi Products Corporation.
   b. Bonsal, W. R., Company.
   c. Custom Building Products.

d. LATICRETE International Inc.
e. MAPEI Corporation.
f. Summitville Tiles, Inc.

2.6 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Prepackaged Cement Grout: ANSI A118.6, color as indicated.

C. Polymer-Modified Prepackaged Tile Grout: ANSI A118.7.

2.7 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the applicable requirements in Division 07 Section "Joint Sealants."

2.8 METAL TRIM

A. Metal Trim, General: Metal trim of profiles indicated to match tile and setting-bed thickness, and of materials indicated.

B. Basis of Design Manufacturer: Where named products are indicated, design, Drawings, and Specifications are based on products manufactured by:

1. Schluter Systems, LP.

a. Subject to compliance with requirements, provide products indicated or comparable products subject to substitution per Division 01 Section “Substitution Procedures.”

C. Metal Trim Profiles:

1. Floor to Wall Transitions: Coved stainless steel transition with 23/32 inch radius cove.

a. Product: Schluter; DILEX-EHK U11/0 11

2. Wall, Inside Corner Transitions: Coved stainless steel transition with 23/32 inch radius cove.

a. Product: Schluter; DILEX-EHK U11/0 11

3. Walls, Outside Corner Transitions: J-shaped bent stainless steel with eased edges and 9 mm (11/32 inch) exposed faces.

a. Product: Schluter; QUADEC Q 90 E

D. Metal Trim Transitions: Provide trim manufacturer's factory fabricated matching trim transitions as required for Project conditions for trim profiles selected.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Product recommended by manufacturer for sealing grout joints that does not change color or appearance of grout.

1. Grout sealers shall comply with requirements of FloorScore certification.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm, dry, clean, and free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where mortar bed installed tile floors are indicated, prepare substrates by applying a reinforced mortar bed that complies with ANSI A108.1A for use with or without a waterproof membrane, or A108B without a waterproof membrane.

    1. Where tile floors are indicated to be sloped, slope 1/4 inch per foot maximum (2%) toward drains.

D. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF TILE

A. Comply with TCNA's " Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

   1. Follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage for tile floors consisting of tiles 8 x 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: 3/16 inch unless otherwise indicated.

G. Lay out tile wainscots to next full tile beyond dimensions indicated.

H. Metal Trim: Install metal trim specified in Part 2 – Products in accordance with manufacturer’s instructions at floor to wall transitions, wall inside corners, wall outside corners, floor and wall tile terminations.

I. Grout Sealer: Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CRACK-ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 REPAIR AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 FLOOR TILE INSTALLATION SCHEDULE

A. Floor Tile Installation FT-1: Ceramic tile over mortar bed (thickset) with cleavage membrane over concrete subfloor.

1. Installation Method: TCNA F111 and ANSI A108.1C, ceramic tile over mortar bed (thickset) over cleavage membrane over concrete.
2. Thin-Set Mortar: Latex-portland cement mortar.
3. Grout: Polymer-modified unsanded grout.

3.8 WALL TILE INSTALLATION SCHEDULE

A. Wall Tile Installation WT-3: Ceramic tile thinset over cementitious backer board.

1. Installation Method: TCNA W244C and ANSI A108.5, wall tile thinset over cementitious backer units.
2. Thin-Set Mortar: Latex-portland cement mortar.
3. Grout: Polymer-modified unsanded grout.

END OF SECTION

SECTION 095113
WOOD AND METAL PANEL CEILINGS

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. Wood veneer ceiling panels for lay-in installation in suspended grid systems.
2. Metal ceiling panels with spring installation clips for installation in suspended grid systems.
3. Suspended grid systems for panel types indicated.

B. Related Requirements:

1. Division 07 Section “Joint Sealants” for acoustical joint sealant.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include statement of VOC content for any adhesives or sealants.

B. Samples for Initial Selection: For components with factory-applied finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Metal Panels: 6-inch square samples of each type, color, pattern, and texture.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES, IAPMO, or equivalent.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Ceiling Units: Full-size panels equal to not less than 2 percent of quantity for each panel type installed.
2. Suspension-System Components: Quantity of each exposed component equal to not less than 2 percent of quantity installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ceiling System Components: Ceiling system components shall comply with ASTM C 635 and Section 5.1 of ASTM E 580.

B. Seismic Performance: Suspended ceiling systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the California Building Code.

C. System components and installation shall comply with Division of the State Architect (DSA) Interpretive Regulation IR 25-2, latest edition.

1. Ceiling System General Notes (DSA IR 25-2, Appendix 'A' Notes 1.01 - 1.06):

   a. IR 25-2, Note 1.01: Ceiling system components shall comply with ASTM C 635 and Section 5.1 of ASTM E 580.
   b. IR 25-2, Note 1.02: The ceiling grid system must be rated heavy duty as defined by ASTM C 635.
   c. IR 25-2, Note 1.03 and 1.04: Suspension component manufacturer, product number, and Evaluation Report information provided in Part 2 Article "Metal Suspension Systems" of this Specification Section.
   d. IR 25-2, Note 1.05: Ceiling panels shall not support any light fixtures, air terminals, or devices.
   e. IR 25-2, Note 1.06: For Ceiling installations utilizing acoustic panels of mineral or glass fiber, it is not mandatory to provide 3/4 inch clearance between the acoustical panel and the wall on the sides of the ceiling which are free to slip. For all other ceiling panel types, provide 3/4 inch clearance between the ceiling panel and the wall on the sides of the ceiling free to slip. Clearance between ceiling grid members and walls shall comply with the details on the drawings regardless of material.

2. Materials (DSA IR 25-2, Notes 2.01 - 2.03):

   a. IR 25-2, Note 2.01: Ceiling wire shall be Class 1 zinc coated (galvanized) carbon steel conforming to ASTM A 641-09a. Wire shall be 12 gauge (0.106 inch diameter) with soft temper and minimum tensile strength of 70 ksi.
   b. IR 25-2, Note 2.02: Galvanized sheet steel (including that used for metal stud and track compression struts/posts) shall conform to ASTM A 653-11, or other equivalent sheet steel listed in Section A3.1 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). Material 43 mil (18 gauge) and lighter shall have a minimum yield strength of 33 ksi. Material 54 mil (16 gauge) and heavier shall have a minimum yield strength of 50 ksi.
   c. IR 25-2, Note 2.03: Electrical metallic tubing (EMT) shall be ANSI C80.3/UL 797 carbon steel with G90 galvanizing. EMT shall have a minimum yield strength (Fy) of 30 ksi and minimum ultimate strength (Fu) of 48 ksi.

3. Attachment of Hanger and Bracing Wires (DSA IR 25-2, Notes 3.01 - 3.05):

   a. IR 25-2, Note 3.01: Separate all ceiling hanger and bracing wires at least 6 inches from all unbraced ducts, pipes, conduits, and similar items.
   b. IR 25-2, Note 3.02: Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to piping, ductwork, conduit, and equipment.
   c. IR 25-2, Note 3.03: Hanger wires that are more than one horizontal in 6 vertical out of plumb shall have counter sloping wires.
   d. IR 25-2, Note 3.04: Slack Safety wires shall be considered hanger wires for installation and testing requirements.

e. IR 25-2, Note 3.05: Hanger and brace wire anchorage to the structure shall be installed in such a manner that the direction of the anchor aligns closely with the direction of the wire. (e.g. bracing wire ceiling clips must be bent as shown in the details and rotated as required to align closely with the direction of the wire, eye screws in wood must be installed so they align closely with the direction of the wire, etc.).

4. Fasteners and Welding (DSA IR 25-2, Notes 4.01 - 4.07):

a. IR 25-2, Note 4.01: Sheet metal screws shall comply with ASTM C 1513-10, ASME B 18.6.4-89 (R 2005). Penetration of screws through joined material shall not be less than three exposed threads.
b. IR 25-2, Note 4.02: Expansion anchors shall be as indicated on Drawings including manufacturer, product, engineering service report number, and test load for each size specified.
c. IR 25-2, Notes 4.03: Power actuated fasteners shall be as indicated on Drawings including manufacturer, product, and engineering service report number.
d. IR 25-2, Notes 4.04: If not otherwise specified in the evaluation report, power actuated fasteners installed in steel shall be installed so the entire pointed end of the fastener is driven through the steel member.
e. IR 25-2, Notes 4.05: Power actuated fasteners in concrete or masonry are not permitted for bracing wires. (Not applicable to project)
f. IR 25-2, Note 4.06: Concrete reinforcement and prestressing tendons shall be located by non-destructive means prior to installing post-installed anchors. (Not applicable to project)
g. IR 25-2, Note 4.07: Welding shall be in accordance with AWS D1.3 using E60XX series electrodes.

5. Testing: (DSA IR 25-2, Notes 5.01 - 5.03).

a. IR 25-2, Note 5.01: All field testing must be performed in the presence of the project inspector.
b. IR 25-2, Note 5.02: Post installed anchors in concrete used to support hanger wires shall be tested at a frequency of 10 percent. Power actuated fasteners in concrete shall be field tested for 200 lbs in tension. All other post-installed anchors in concrete shall be tested in accordance with CBC Section 1910A.5. (Not applicable to project)
c. IR 25-2, Note 5.03: Post installed anchors in concrete used to attach bracing wires shall be tested at a frequency of 50 percent in accordance with CBC Section 1910A.5. (Not applicable to project)

6. Light Fixtures (DSA IR 25-2, Notes 6.01 - 6.05):

a. IR 25-2, Note 6.01: All light fixtures shall be positively attached to the ceiling suspension system by mechanical means to resist a horizontal force equal the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture per ASTM E 580, Section 5.3.1.
b. IR 25-2, Note 6.02: Surface mounted fixtures shall be attached to the main runner with at least 2 positive clamping devices. The clamping device shall completely surround the supporting ceiling runner and be made of 14

gauge minimum thickness sheet steel; rotational spring catches do not comply. A 12 gauge slack safety wire shall be connected from each clamping device to the structure above. Provide additional supports when light fixtures are 8 feet or longer, or exceed 56 lbs. Maximum spacing between supports shall not exceed 8 feet.

c. IR 25-2, Note 6.03: Light fixtures weighing less than or equal to 10 lbs may be supported directly on the ceiling runners, but shall have a minimum of one 12 gauge slack safety wire connected from the fixture hosing to the the structure above.

d. IR 25-2, Note 6.04: Light fixtures weighing greater than 10 lbs, but less than or equal to 56 lbs, may be supported directly on the ceiling grid members, but they shall have a minimum of two (2) 12 gauge slack safety wires connected from the fixture housing at diagonal corners to the structure above.

1) Exception: All light fixtures greater than 2 by 4 ft weighing less than 56 lbs shall have a 12 gauge slack safety wire at each corner.

e. IR 25-2, Note 6.05: Light fixtures weighing greater than 56 lbs shall be independently supported by not less than 4 taut 12 gauge wires (one at each corner) attached from the fixture housing to the structure above or other approved hangers. The 4 taut 12 gauge wires or other approved hangers, including their attachment to the structure above, shall be capable of supporting 4 times the weight of the fixture.

7. Services within the Ceiling (DSA IR 25-2, Notes 7.01 - 7.04):

a. IR 25-2, Note 7.01: All flexible sprinkler hose fitting mounting brackets, ceiling mounted air terminals, or other services, shall be positively attached to the ceiling suspension system by mechanical means. Screws or approved fasteners are required. A minimum of 2 attachment points are required at each component.

b. IR 25-2, Note 7.02: Ceiling mounted air terminals or other services weighing less than or equal to 20 lbs shall have one slack safety wire attached from the terminal or service to the structure above.

c. IR 25-2, Note 7.03: Flexible sprinkler hose fittings, ceiling mounted air terminals or other services weighing more than 20 lbs, but less than or equal to 56 lbs, shall have a minimum of two (2) 12 gauge slack safety wires (at diagonal corners) connected from terminal or service to the structure above.

d. IR 25-2, Note 7.04: Flexible sprinkler hose fittings, ceiling mounted air terminals, or other services weighing more than 56 lbs shall be supported directly from the structure above by not less than 4 taut 12 gauge hanger wires attached from the terminal or service to the structure above or other approved hangers.

8. Other Devices within the Ceiling (DSA IR 25-2, Note 8.01):

a. IR 25-2, Note 8.01: All lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling grid. In addition, devices weighing more than 10 lbs shall have a

12 gauge slack safety wire anchored to the structure above. Devices weighing more than 20 lbs shall be supported independently from the structure above.

2.2 MANUFACTURERS

A. Basis-of-Design Manufacturer: Where named manufacturer's products are indicated in other Part 2 Articles, design, Drawings and Specifications are based on products manufactured by:

1. USG Interiors, Inc.; Subsidiary of USG Corporation.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) Armstrong World Industries, Inc.
2) BPB USA.
3) CertainTeed Corp.

B. Source Limitations: Obtain ceiling panels and grid systems from a single source from a single manufacturer.

2.3 WOOD VENEER CEILING PANELS

A. Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, and patterns unless otherwise indicated.

B. Wood Veneer Acoustic Panels: Manufacturer's standard core with wood veneer face and integrated acoustical backer.

C. Panel Types:

1. Type ACP-1: USG Interiors; True Wood Lay-in Panels complying with the following:

a. Classification: ASTM E1264 Type XX composite wood panel.
b. Core: MDF core with no added urea formaldehyde (NAUF).
c. Size: 24 x 48 x 3/4 inches.
d. Weight: 3 psf.
e. Edge: 'SL' reveal edge for 15/16 inch grid systems.
f. Face Veneer: To be selected from manufacturer's standard veneers.
g. Finish: Factory finish of stain and sealer, color and finish to be selected from manufacturer's standard colors and finishes.

h. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: Class A according to ASTM E 1264.
2) Smoke-Developed Index: 50 or less.

2.4 METAL CEILING PANELS

A. Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, and patterns unless otherwise indicated.

B. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.

1. Aluminum Sheet: Rolled aluminum sheet, complying with ASTM B209; alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Metal Ceiling Panel Types:

1. Metal Panel Type PMC-1:

a. Product: USG Interiors: “Celebration” Series torsion spring metal ceiling panels.

1) Metal panels designed to be installed to the underside of the suspension grid and retained by spring clips installed through slots in the face of the suspension grid.

b. Material: Aluminum.
c. Size:

1) Standard Panel: 24 x 48 inches.
2) Custom Panel: 20 x 48 inches; where indicated for use with adjacent 4 inch wide light fixtures.

d. Weight: 0.63 lbs/sf, 5 lbs/panel.
e. Pattern: Perforated, custom perforations of randomly sized square holes randomly arrainged.
f. Edge: Square.
g. Color: `To be selected by architect from manufacturer’s standard powder coat colors.
h. Sound-Absorbent Pads: Panel manufacturer’s sound absorbent pad of size to completely fill concealed surface of pan, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing according to ASTM E84.

2.5 METAL SUSPENSION SYSTEMS

A. Source Limitations, Suspension Systems: Obtain suspensions systems from a single source from a single manufacturer.

B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M, and Section 5.1 of ASTM E580.

1. Main runners, cross runners, splices, expansion devices, and intersection connectors shall be designed to carry a mean ultimate test load of not less than 180 lbs in compression and tension per ASTM E 580 Section 5.1.2.

C. Wide-Face, Capped, Double-Web Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch wide metal caps on flanges.

1. Use/Location: Suspension system for use with non-metallic acoustical panels.
2. Structural Classification: Heavy-duty system.
3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flat, flush.
5. Cap Material: Steel cold-rolled sheet.
6. Cap Finish:

a. Grids for Wood Panel Ceilings: Color to match wood panels as closely as possible selected from manufacturer’s standard grid colors.
b. Grids for Metal Panel Ceilings: Color to match metal panels as closely as possible selected from manufacturer’s standard grid colors.

7. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. USG/Donn; DX/DXL Series suspension grid (ESR-1222) for panels with torsion spring clip installation.

1) Main Runners: No. DXL26 or DXL26HRC.
2) Cross Runners for Acoustic Panel Ceilings:

a) 2 Foot Length: DX/DXL 216.
b) 4 Foot Length: DX/DXL 424.

3) Cross Runners for Metal Panel Ceilings: Cross runners designed to accept metal panels with torsion spring clip installation.

a) 2 Foot Length: TSCT22.
b) 4 Foot Length: TSCT44.

4) Perimeter Seismic Clips: No. ACM7.

b. Design is based on a ceiling system using proprietary perimeter seismic clips and has been approved by DSA; substitutions will require a Substitution Request and processing a DSA Construction Change Document.

D. Edge Moldings and Trim: Manufacturer's standard roll formed sheet metal angle edge molding and trim with hemmed edges having nominal 7/8 inch legs, that fit acoustical panel edge details and suspension systems indicated, and comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Perimeter Seismic Clips: Provide manufacturer’s proprietary perimeter seismic clips at ends of main and cross runners at wall angles to comply with seismic standards indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.6 METAL TRIM FOR EXPOSED EDGE CEILING SYSTEMS

A. Basis-of-Design: Drawings and Specifications are based on the following:

1. USG Interiors; Compasso trim, CP610.

   a. Subject to compliance with requirements, provide products indicated or submit request for substitution.

2. Trim:

   a. Material: Extruded aluminum alloy 6063.
   b. Vertical Face: 6 inches.
   c. Length: 120 inches.
   d. Finish: Powder coat or baked polyester paint, color to match grid for metal ceiling panels as closely as possible selected from manufacturer’s standard colors..
   e. Inside Corners: Manufacturer’s standard preformed inside corners.
   f. Outside Corners: Manufacturer’s standard preformed outside corners.

3. Accessories: Manufacturer’s standard.

2.7 ACCESSORIES

A. Attachment Devices: As indicated on Drawings; attachment devices to be sized for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Power-Actuated Fasteners in Steel: Fasteners as indicated on Drawings fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

1. Power actuated fasteners installed in steel shall be installed so the pointed end of the fastener is driven through the steel member unless otherwise indicated in the evaluation report.

C. Sheet Metal Screws: Comply with ASTM C1513-10, ASME B18.6.4-89 (R2005). Penetration of screws through joined material shall be not less than three exposed threads.

D. Hanger and Brace Wires: Class 1 zinc-coated (galvanized) carbon-steel wire conforming to ASTM A 641-09a; wire to be 12 gauge (0.106 inch diameter) with soft temper and minimum tensile strength of not less than 70 ksi.

E. Seismic Struts: Metal stud sections of size indicated on Drawings of galvanized steel sheet conforming to 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). Material 43 mil (18 gauge) and lighter shall have a minimum yield strength of 33 ksi; material 54 mil (16 gauge) and heavier shall have a minimum yield strength of 50 ksi.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

2.8 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Division 07 Section “Joint Sealants." Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and

anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION, GENERAL

A. General: Install ceilings to comply with ASTM C 636/C 636M, Section 5.2 of ASTM E 580, and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Ceiling System Installation shall comply with DSA IR 25-2, latest edition; requirements included in Part 2 Article “Performance Requirements” of this specification Section.

3.4 INSTALLATION OF HANGER AND BRACE WIRES

A. Anchors and/or Clips for Hanger and Brace Wires: Anchors and/or Clips for hanger and brace wires shall be installed in such a manner that the direction of the anchor/clip aligns as closely as possible with the direction of the wire.

B. Hanger Wires: Suspend ceiling hanger wires from the building's structural members and attach to grid members as indicated on Drawings and as follows:

1. Install hanger wires spaced not more than 4 feet on center along main runners and not more than 8 inches from ends of runners at the perimeter of the ceiling.
2. Install hanger wires at cross runners at the perimeter of the ceiling area not more than 8 inches from edges or one-fourth the length of the runner whichever is least. Perimeter wires are not required when the length of the runner is 8 inches or less.
3. Install hanger wires plumb and free from contact with insulation or other objects within the space above the ceiling that are not part of supporting structure or of ceiling suspension system. Hanger wires shall be separated from unbraced pipes, ducts, conduits, and similar items a minimum of 6 inches.
4. Secure hanger wires to ceiling suspension grid members and to supports above with a minimum of three tight turns in 3 inches. Hanger wire loops shall be tightly

wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops.

5. Hanger wires shall not attach to or bend around interfering material or equipment. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing.
6. Provide additional hangers, struts, or braces as required at all ceiling breaks, soffits, or discontinuous areas.
7. Splay hanger wires only where required to miss obstructions; hanger wires that are more than one horizontal to 6 vertical out of plumb shall have counter sloping wires. Counter sloping wires are not required at perimeter hanger wires at main runners that are positively attached to the perimeter wall closure angle.

C. Seismic Bracing/Hanger Wires and Compression Struts: Seismic bracing shall consist of a compression strut and sets of 4 splayed brace wires oriented 90 degrees from each other attached to suspension grid main runners and the structure above as indicated on Drawings and as follows:

1. Space bracing assemblies not more than 12 feet on center each way and not more than 6 feet from walls.
2. Secure brace wires to ceiling suspension main runners and to building structural members above with a minimum of four tight turns in 1-1/2 inches.

    a. Brace wires shall attach to main runners within 2 inches of the intersection of main and cross runners.
    b. The slope of brace wires shall not exceed 45 degrees from the plane of the ceiling.
    c. Brace wires shall be separated from unbraced pipes, ducts, conduits, and similar items a minimum of 6 inches.

3. Compression struts shall attach to ceiling grid main runners at the intersection of the brace wires and shall be installed not more than 1 horizontal to 6 vertical out of plumb.
4. Ceiling areas of 144 square feet or less surrounded by walls attached or braced to the structure above shall not require seismic bracing.
5. Free floating ceilings (Ceilings not entirely surrounded by walls on all sides) shall be seismically braced regardless of area.

3.5 INSTALLATION OF GRID MEMBERS AND WALL TRIM

A. Edge Molding and Trim at Walls: Install trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Positively attach trim to the wall as indicated on Drawings.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 24 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

B. Edge Molding and Trim at Free Floating Ceiling Areas: Install trim of type indicated at perimeter of free floating ceiling area and where necessary to conceal edges of panels. Positively attach trim to the grid members as indicated on Drawings.

C. Suspension Grid Members: Install suspension grid members so they are level, square, and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

1. Install grid members to form standard 2 foot x 4 foot or 2 foot by 2 foot grid layout as indicated on Drawings.

   a. Main runners shall be spaced 4 feet on center and shall be supported by hanger wires spaced not more than 4 feet on center along the main runner.
   b. 4 foot long cross runners shall be installed perpendicular to main runners and spaced 24 inches on center.
   c. 2 foot long cross runners shall be installed perpendicular to the 4 foot cross runners at the mid-point of the 4 foot cross runners (For 2 foot by 2 foot grid layouts).

2. Grid members shall be attached to metal wall angle trim two adjacent walls per ASTM E 580, Section 5.2.3; grid members shall be at least 3/4 inches clear of other walls.

   a. Proprietary seismic clips shall be installed at each grid member at walls of the ceiling area where grid members are not connected to the adjacent wall angle trim; seismic clips shall be securely fastened to the wall; seismic clips shall allow the grid member 3/4 inch movement in compression and in tension.

3. Expansion joints shall be provided between grid members at the intersections of corridors and at the junctions of corridors and lobbies or similar areas.
4. Seismic separations shall be provided to divide large ceiling areas into smaller areas so that no undivided ceiling area exceeds 2,500 sf. Alternately, comply with ASTM E 580, Section 5.2.9

3.6 INSTALLATION OF CEILING PANELS, GENERAL

A. General: Install ceiling panels in accordance with manufacturer's written installation instructions.

B. Install ceiling panels with undamaged edges and fit accurately to suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

C. Provide oversize penetrations through ceiling panels for sprinkler heads and similar rigid penetrating items that are not connected to the ceiling system; penetrations shall be 2 inches minimum oversized to allow for horizontal movement of 1 inch in all directions.

1. Penetrations shall be finished with escutcheons to seal off oversized openings; escutcheons shall allow for movement of 1 inch minimum in all directions

D. Arrange directionally patterned acoustical panels with pattern running in one direction.

3.7 INSTALLATION OF WOOD CEILING PANELS

A. Cut to fit irregular grid and perimeter edge trim. Make field-cut edges of same profile as factory edges, seal and finish according to manufacturer.

3.8 INSTALLATION OF METAL CEILING PANELS

A. Panels are designed to be installed to the underside of the suspension grid and are held in place with not less 4 torsion springs per panel; torsion spring legs are to be inserted through slots in the suspension grid system.

3.9 INSTALLATION OF ACCESSORIES

A. Light Fixtures: All light fixtures shall be positively attached to the ceiling suspension system by mechanical means per CEC Article 410.36 to resist a horizontal force equal the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture per ASTM E 580, Section 5.3.1.

1. Surface mounted fixtures shall be attached to the main runner with at least 2 positive clamping devices on each fixture; the clamping device shall completely surround the supporting ceiling runner and be made of 14 gauge minimum thickness sheet steel; rotational spring catches do not comply. A 12 gauge slack safety wire shall be attached to each clamping device and to the structure above. Provide additional supports when light fixtures are 8 feet or longer or exceed 56 lbs. Maximum spacing between supports shall not exceed 8 feet.
2. Light fixtures weighing not more than 10 lbs shall have a minimum of one 12 gauge slack safety wire connected to the fixture hosing and the structure above.
3. Light fixtures weighing more than 10 lbs, but not more than 56 lbs, may be supported directly on the ceiling grid members, but they shall have a minimum of two 12 gauge slack safety wires connected to the fixture housing at diagonal corners and anchored to the structure above. Light fixtures greater than 2 by 4 ft weighing less than 56 lbs shall have a 12 gauge slack safety wire at each corner.
4. Light fixtures weighing more than 56 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the fixture housing, one at each corner, and the structure above; the 4 taut wires, including their attachment to the structure, must be capable of supporting 4 times the weight of the fixture.
5. Pendant mounted fixtures shall be supported directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 2 times the weight of the fixture. Refer to DSA IR 16-9 for additional requirements for pendant fixtures.

B. Fire Sprinklers: If provided, flexible sprinkler hose fittings shall be positively attached to the ceiling suspension system by mechanical means to resist a horizontal force equal to the weight of the component; screws or approved fasteners are required. A minimum of 2 attachment points are required at each component.

1. Flexible sprinkler hose fittings weighing not more than 20 lbs shall have one 12 gauge slack safety wire attached to the fitting and the structure above.
2. Flexible sprinkler hose fittings weighing more than 20 lbs, but not more than 56 lbs, shall have a minimum of two 12 gauge slack safety wires connected to the fixture housing and the structure above.
3. Flexible sprinkler hose fittings weighing more than 56 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the fixture and the structure above. The 4 taut wires including their attachment to the structure must be capable of supporting 4 times the weight of the fixture.

C. Air Terminals and Other Services: Ceiling mounted air terminals and/or other services shall be positively attached to the ceiling suspension system by mechanical means to resist a horizontal force equal to the weight of the component; screws or approved fasteners are required. A minimum of 2 attachment points are required at each component.

1. Ceiling mounted air terminals and/or other services weighing not more than 20 lbs shall have one 12 gauge slack safety wire attached to the terminal or service and the structure above.
2. Ceiling mounted air terminals and/or other services weighing more than 20 lbs, but not more than 56 lbs, shall have a minimum of two 12 gauge slack safety wires connected to the terminal or service and the structure above.
3. Ceiling mounted air terminals and/or other services weighing more than 56 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the terminal or service and the structure above. The 4 taut wires including their attachment to the structure must be capable of supporting 4 times the weight of the terminal or service.
4. Lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling suspension system by mechanical means to resist a horizontal force equal to the weight of the component; screws or approved fasteners are required. A minimum of 2 attachment points are required at each component.

    a. Devices weighing more than 10 lbs, and not exceeding 20 lbs, shall have a minimum of one 12 gauge slack safety wire connected to the fixture hosing and the structure above.
    b. Devices weighing more than 20 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the fixture and the structure above. The 4 taut wires including their attachment to the structure must be capable of supporting 4 times the weight of the fixture.

D. Metal and Other Panels: Metal panels and panels weighing more than 1/2 psf, other than mineral fiber acoustic panels, shall be positively attached to the suspension grid members.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements. Field testing shall be performed in the presence of the project inspector. Testing and inspecting shall be required for the following:

1. Power-actuated anchors in concrete for hanger wires.

   a. Hanger Wires: Within each test area, testing agency will select 1 of every 10 anchors used to attach hanger wires to concrete and test them for 200 lbf of tension.

      1) Power actuated fasteners in concrete shall not be permitted for brace wires.

2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

C. Remove and replace hangers, anchors, and fasteners that do not pass tests and inspections and retest as specified above.

3.11 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096001
FLOORING MOISTURE AND pH TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control for flooring moisture and pH testing of interior concrete slabs.

1. Owner will engage a qualified testing agency to perform tests and inspections.

B. Related Sections include the following:

1. Division 01 Section “Quality and Testing Requirements.”
2. Division 03 Section “Topical Concrete Vapor Control Barrier”
3. Division 09 Sections as applicable to adhered flooring materials.

1.3 REFERENCES

A. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.

B. ASTM F 710 Standard Practice for Preparing Concrete Floors to receive Resilient Flooring.

C. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.4 TESTING AGENCY

A. General: Owner will engage a qualified testing agency to conduct tests and inspections specified.

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

1. Perform testing as required by the Contract Documents.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Taking all test specimens.
4. Prepare written reports of tests and inspections, and submit reports of each test, inspection, and similar quality-control service to Architect and Contractor.
5. Retesting and reinspecting corrected work.
6. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
7. Do not perform any duties of Contractor.

1.5 CONTRACTOR REQUIREMENTS

A. Contractor Responsibilities:

1. Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

   a. Access to the Work.
   b. Incidental labor and facilities necessary to facilitate tests and inspections.

2. 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.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Testing shall not occur until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Maintain ambient temperatures within range recommended by manufacturers of flooring products, but not less than 68 deg F or more than 80 deg F, in spaces to receive adhered flooring products during the following time periods:

   a. 48 hours before testing.
   b. During testing.
   c. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturers of flooring products, but not less than 68 deg F or more than 80 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. The following materials and equipment shall be the responsibility of the Owner's testing agency:

1. Test Kit as manufactured by American Moisture Test, Inc., Tramex, LTD.

   a. ASTM F 1869 water vapor emission test.
   b. ASTM F 2170 relative humidity test.
   c. ASTM F 710 digital alkalinity-pH, wide range 1-14pH.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor Responsibilities: Prepare concrete substrates according to ASTM F 710 and flooring manufacturers' written instructions to ensure adhesion of resilient products.

1. Verify that substrates are dry, free of curing compounds, sealers, and hardeners, and are compatible to receive adhesive applied flooring products.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Mechanically abrade and/or grind a 20 inch by 20 inch area to remove adhesives, paint, curing/sealing compounds, and similar residue a minimum of 24 hours prior to application of testing equipment at each test location for water vapor emission testing.

   a. Do not abrade surface where topical concrete vapor control barriers have been applied; clean surface of contamination and directly apply testing equipment to treated surface(s) without scarification methods.

B. Temperature and Humidity: Maintain spaces at the temperature and humidity conditions anticipated during normal occupancy and as specified in Part 1 Article "Field Conditions" before, during, and after testing.

1. Testing shall be performed under HVAC controlled conditions, testing performed without HVAC controlled conditions shall be subject retesting prior to flooring application.

3.2 TESTING

A. Testing: Testing Agency shall perform tests as follows:

1. Anhydrous calcium chloride test, ASTM F 1869.

   a. Do not mechanically abrade concrete surfaces that have been treated with a topical vapor control barrier.
   b. Perform all gram scale weights on site.
   c. Expose dome for 60 to 72 hours.
   d. Report results as pounds of emission per 24 hours per ASTM F 1869.

      1) Satisfactory results shall have a maximum moisture-vapor-emission rate of not more than 3 lb of water/1000 sq. ft. in 24 hours.

2. Relative humidity test using in situ probes, ASTM F 2170.

   a. Test method not required for areas sealed with Topical Vapor Control Barrier.
   b. Satisfactory results shall have a maximum 75 percent relative humidity level measurement.

3. Testing for pH:

   a. Apply pH solution to form a 1-inch diameter circle directly to interior of moisture dome.
   b. Allow to absorb into concrete for 1 minute.
   c. Apply flat tip pH meter to solution and document result as required by manufacturer.
   d. Satisfactory results shall have a pH level of not less than 5 or more than 9.

4. Frequency of Testing: Apply tests at a rate of three (3) test locations for areas up to 1,000 square feet and one (1) test per each 1,000 square feet thereafter. Note test location and number on next to test for future identification.

5. Do not proceed with flooring installation until satisfactory results are achieved or a topical vapor control barrier is applied.

3.3 REPAIR

A. General: On completion of testing, contractor shall repair damaged construction and restore substrates and finishes.

1. Use materials for patching identical to in-place materials; refer to applicable specification sections for materials and installation. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
2. Comply with the requirements 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.

D. Test Results shall be reported in similar fashion as the American Moisture Test “Report 100” as follows:

Interior Test Conditions	Relative Humidity (%)	Air Temp. (˚F)
Start of Test		
End of Test		
ASTM Requirement	50 ± 10 % RH	75 ± 10° F

Results	Moisture Vapor Emission Rate (MVER) / Relative Humidity	pH
Highest	/	
Lowest	/	
Acceptable	3.0 lbs. / 75% RH	9.0pH

Location	ASTM F-1869-04 Calcium Chloride Data							Results	
	Start Date/Time	End Date/Time	Elapsed Time	Start Weight	Ending Weight	Weight Gain	Concrete Surface Temp Start / End	Digital pH	MVER / Relative Humidity

END OF SECTION

SECTION 096513
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.3 SUBMITTALS

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

1. Include statement of VOC content for any adhesives or sealants.

B. Samples for Initial Selection: For color and texture for each product indicated.

C. Product Schedule: For resilient products, use same designations as Contract Documents.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
3. Roppe Corporation, USA.

B. Resilient Base: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style: Cove (base with toe).
2. Minimum Thickness: 0.125 inch.
3. Height: 4 inches unless otherwise indicated on Drawings.
4. Lengths: Cut lengths 48 inches long, or coils in manufacturer's standard length.
5. Outside Corners: Preformed.
6. Inside Corners: Job formed or preformed.
7. Colors: As selected by Architect from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
3. Roppe Corporation, USA.

B. Resilient Molding Accessories: Flooring terminations, transitions, reducer strips, and accessories as indicated and/or required for project conditions.

1. Material: Rubber.
2. Profile and Dimensions: As indicated in Drawings and/or as required for project conditions.
3. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: VOC content of not more than 50 g/L.
b. Rubber Floor and Stair Tread Adhesives: VOC content of not more than 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Outside Corners: Install preformed corners; install corners before installing straight pieces.

H. Inside Corners: Install preformed or job formed inside corners.

1. Preformed Corners: Install preformed corners before installing straight pieces.
2. Job-Formed Corners: Use straight pieces of maximum lengths possible and form returns with not than 6 inches in length, miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

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.
2. Division 09 Section “Flooring Moisture and pH Testing.”

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 FEILD 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.

3. Warranties and Warranty Periods:

    a. Wear Warranty: Manufacturer's limited lifetime warranty including face wear, moisture barrier, delamination, tuft bind, unraveling, and static protection.
    b. Stain Resistance: Manufacturer's limited lifetime warranty against staining.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sustainability Requirements: Carpet shall comply with 2019 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.

2.3 CARPET TILE

A. Basis of Design: Drawings and Specifications are based on the following:

1. Mohawk Group; Denim Collection, GT296 Zip It Tile 12 x 36 Modular carpet tile.

   a. Subject to compliance with requirements, provide product indicated or a comparable product subject to Request for Substitution.

B. Physical Characteristics:

1. Size: 12 by 36 inches, modular tiles.
2. Construction: Tufted.
3. Surface Texture: Textured patterned loop.
4. Fiber Type: Duracolor Premium Nylon
5. Dye Method: Solution dyed/yarn dyed.
6. Stain Release Technology: Permanent, built into fiber.
7. Soil Release Technology: EcoSentry soil protection.
8. Gauge: 1/12.
9. Stitches per Inch: 11.0.
10. Finished Pile Thickness: 0.092 inches.
11. Total Thickness: 0.318 inches.
12. Tufted Pile Weight: 18 ounces per square yard.
13. Average Density: 7,043.
14. Weight Density: 126,782.
15. Backing Material: EcoFlex NXT.
16. Color: As indicated on Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

C. Performance Characteristics:

1. Flammability: ASTM E 648, Class 1 (Glue down).
2. Smoke Density: ASTM E 662. less than 450.
3. Electrostatic Propensity: AATCC 134, less than 3.5 KV.
4. CRI Indoor Air Quality Control Green Label Plus ID: GLP1171.

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:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. 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 098436
SOUND-ABSORBING CEILING BAFFLES

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. Sound-absorbing ceiling baffles, shop fabricated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product; include fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For unit assembly and installation.

1. Include reflected ceiling plans, elevations, sections, and mounting devices and details.
2. Include details at joints and corners; and details at ceiling intersections and intersections with walls. Indicate panel edge profile and core materials.
3. Include direction of fabric weave and pattern matching.

C. Samples for Initial Selection: For each type of fabric facing.

1. Include Samples of hardware and accessories involving color or finish selection.

D. Samples for Verification: For the following products:

1. Fabric: Not less than 24 inch square sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied.
2. Mounting Devices: Full-size Samples.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components above ceiling units.
2. Structural members to which suspension devices will be attached.
3. Items penetrating or covered by units including the following:

   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Alarms.
   e. Sprinklers.

4. Show operation of hinged and sliding components covered by or adjacent to units.

B. Product Certificates: For each type of unit.

C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

1.6 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. Ceiling Baffle Panels: Not less than 5% of the panels installed.
2. Mounting Devices: As required for mounting not less than 5% of the panels installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Acoustical performance.
b. Fabric sagging, distorting, or releasing from panel edge.
c. Warping of core.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain ceiling units specified in this Section from a single source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, 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 E84 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: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.3 SOUND-ABSORBING CEILING BAFFLES

A. Sound-Absorbing Baffle Panel: Manufacturer's standard panel construction consisting of facing material laminated to front and back faces and edges of core.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. SONEX/Pinta Acoustics, Inc.; Clean Acoustic Baffles.

1) Subject to compliance with requirements, provide product specified or equivalent product subject to request for substitution per Division 01 Section “Substitution Procedures.”

2. Panel Shape: Flat.
3. Size: 48 inches wide by 24 inches high by 2 inches thick nominal dimensions.
4. Mounting: Top-edge mounted with manufacturer's standard suspension system secured to substrate.
5. Core: Manufacturer's standard fire retardant foam plastic core, 0.5 to 0.7 lbs./CF density; with flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E84 or UL 723.
6. Edge Profile: Square.
7. Corner Detail in Elevation: Square, with continuous edge profile indicated.
8. Facing Material: Manufacturer’s standard vinyl facing.
9. Acoustical Performance: Sound absorption, 8.20 average Sabins per baffle per ASTM C 423, hanging baffle.

B. Mounting Devices: Manufacturer’s standard top edge of unit suspension hardware, recommended by manufacturer to support weight of unit.

2.4 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners, heat-seal vinyl fabric seams at corners.

C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

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

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation from Level or Slope: Plus or minus 1/16 inch.

C. Variation of Joint Width: Not more than 1/16 inch wide from in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION

SECTION 099100
PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and field painting, staining or refinishing of the following:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

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

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 08 Sections for shop priming of metal doors and frames with primers specified in this Section.
3. Division 09 Section "Gypsum Board" for sealing gypsum board surfaces before application of surface textures with primers/sealers specified in this Section.
4. Division 09 Section “Gaffiti-Resistant Coatings” for graffiti-resistant coatings.
5. Division 21 through 23 Sections for additional requirements for painting of plumbing and mechanical items.
6. Division 26 through 28 Sections for additional requirements for painting of electrical items.
7. Division 32 Section “Paving Specialties” for pavement markings.

1.3 DEFINITIONS

A. Definitions of gloss levels below are from "MPI Architectural Painting Specification Manual" (hereafter, "MPI Manual").

1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
2. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
3. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

4. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
5. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
6. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on 8 inch square samples of actual material to be painted or stained. For masonry surfaces, include a mortar joint.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

E. Coating Maintenance Manual: Submit with Closeout/Maintenance Submittals a Coating Maintenance manual; manual shall include a floor plan with rooms identified by name and number, a finish schedule coordinated with the floor plan, designations of where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.

2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F.

1. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
2. Keep storage area neat and orderly. Remove oily rags and waste daily.
3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply paints only when the temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Protection:

1. Cover or otherwise protect finished work of other trades, work not to be painted concurrently, landscaping, and adjacent property from damage.
2. When not in use, store paints in designated areas. Keep containers closed. At end of day's work, remove empty containers, paint soaked rags, and debris. Vent fumes. Take precautions to prevent fire.

D. Sequencing, Scheduling:

1. Coordinate removal and replacement of hardware, electrical fixtures and trim, and related work of other Sections.
2. Stain, prime, back paint, and pre-finish items before installation as required.

E. Cleaning and Disposal:

1. Do not use Project plumbing fixtures or piping systems for:

a. Cleaning painting equipment and utensils.
b. Disposal of waste from cleaning or disposal of paints.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Scheduled Paint Systems: Provide paint systems as scheduled on the Drawings and listed in Part 3 Article “Paint Systems” to comply with requirements in this Section.

1. Named Manufacturers' Products: Manufacturer and product designations indicated in the scheduled paint systems are for the purpose of establishing minimum requirements; unless otherwise indicated, paint products are based on products manufactured by the following:

a. Sherwin Williams Paints.

1) Subject to compliance with requirements, provide the named products or comparable products by one of the following:

a) Dunn-Edwards Paints.
b) Glidden Professional.
c) PPG Paints.
d) Tnemec.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. VOC Content: Paints and coatings applied at the Project site shall comply with VOC limits of authorities having jurisdiction; VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and VOC limits of the California Green Building Standards Code (CGBSC), Section 5.504.4.3 and Table 504.4.3 as follows:

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.

D. Colors: Provide color selections made by the Architect. Colors shall be factory mixed and match approved samples.

2.3 INTUMESCENT PAINTS

A. Intumescent Paint: Water based latex post treatment interior fire retardant intumescent paint; non-toxic and mold resistant.

1. Product: Flame Stop Inc.; Flame Stop IM.
2. Flame Spread: Zero (0) per ASTM E 84; 30 Minute Test Method of Test of Surface Burning Characteristics of Building Materials.
3. VOC Content: Not more than 50 g/L.
4. Applied Thickness: Two coats, each coat applied at a rate of 200 sf/gal.
5. Color and Gloss: As selected by Architect from manufacturer's full range.
6. Substrate Primers: Primers approved by intumescent paint manufacturer; use where manufacturer recommends use of a primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Portland Cement Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

G. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. Concrete and Masonry Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Perform appropriate tests to determine alkalinity and moisture content of surfaces; testing shall be performed or witnessed by a certified representative of the paint manufacturer. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

1. Cracks and defects at concrete and masonry surfaces shall be filled with cement grout; match surface texture.
2. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Aluminum Substrates: Remove loose surface oxidation.

I. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required.

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood.

   a. When transparent finish is required, backprime with spar varnish.
   b. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
   c. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

K. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

L. Drywall: Fill any cracks or defects with drywall joint compound. Sand any rough spots smooth. Do not raise nap on paper covering.

3.3 APPLICATION

A. General: Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual." Paint/stain exposed surfaces, except where schedules indicate that a surface or material is not to be painted/stained or is to remain natural. If schedules do not specifically mention an item or surface to be painted, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
7. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
8. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
9. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

   a. Prefinished items include the following factory-finished components:

      1) Aluminum storefronts and entrances.
      2) Anodized aluminum gypsum board and plaster trim.
      3) Acoustical wall panels.
      4) Toilet and urinal partitions.
      5) Stainless steel items.
      6) Finished mechanical and electrical equipment.
      7) Light fixtures.
      8) Distribution cabinets.

   b. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

F. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

G. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

N. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Paint the following work where exposed to view at applications indicated:

1. Equipment rooms:

a. Telecommunications backboards; paint with intumescent paint.

2. Occupied areas:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Ducts, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
i. Other items as directed by Architect.

3. Exterior locations:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.

3.4 CLEANING AND PROTECTION

A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. Correction of Defective Work:

1. Repair abraded, damaged or incomplete paint surfaces by methods acceptable to Architect. Spot repairs to be well-blended into adjacent work. For large repairs, re-coat entire plane or building element in which damaged area occurs.
2. Defaced surfaces of work not to be painted shall be cleaned and their original finish restored.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 PAINT SYSTEMS

(Interior and exterior paint systems are on the following pages)

A. Interior Paint Systems:

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(1)	Gypsum Drywall	P12.A	Flat, Latex	First Coat Second Coat Third Coat	B28 B30 B30	ProMar 200 Zero Primer ProMar 200 Zero Flat ProMar 200 Zero Flat
		P12.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B28 B31 B31	ProMar 200 Zero Primer ProMar 200 Zero SG ProMar 200 Zero SG
		P12.C	Eggshell Enamel Latex	First Coat Second Coat Third Coat	061 B20 B20	ProMar 200 Zero Primer ProMar 200 Zero EG ProMar 200 Zero EG
	(Textured)	P12.D	Flat	One Coat	A44	Tuff Surface
(2)	Wood	P13.A	Semi-Gloss Latex	First Coat Second Coat Third Coat	B28 B31 B31	Premium Wall & Wood ProMar 200 Zero SG ProMar 200 Zero SG
		P13.B	Eggshell Enamel, Latex	First Coat Second Coat Third Coat	168 A75 A75	Premium Wall & Wood Solo EG Solo EG
		P13.C	Lacquer Velvet	Stain First Coat Second Coat Third Coat	 15700 27520 27520	Minwax 250 Sanding Sealer High Solids Velvet Lacquer High Solids Velvet Lacquer
		P13.D	Lacquer Semi-Gloss	Stain First Coat Second Coat Third Coat	 15700 27540 27590	Minwax 250 Sanding sealer High Solids S.G. Lacquer High Solids S.G. Lacquer
		P13.E	Lacquer Gloss	Stain First Coat Second Coat Third Coat	 15700 27590 27590	Minwax 250 Sanding Sealer High Solids Gloss Lacquer High Solids Gloss Lacquer
		P13.F	Varnish Velvet	Stain First Coat Second Coat Third Coat	 A68 A68 A68	Minwax 250 Wood Classics Wood Classics Wood Classics
		P13.G	Varnish Semi-Gloss	Stain First Coat Second Coat Third Coat	 A68 A68 A68	Minwax 250 Wood Classics Wood Classics Wood Classics
(2A)	Telecom Plywood Backboard	P13.H	Intumescent Paint	Primer First Coat Second Coat		(Primer if req. by intumescent paint mfr) Flame Stop IM Flame Stop IM

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(3)	Ferrous Metal	P14.A	Flat Latex	First Coat Second Coat Third Coat	B66310 A74 A74	ProCryl Metal Primer Solo Flat SoloFlat
		P14.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B66310 A76 A76	ProCryl Metal Primer Solo SG Solo SG
	Ferrous Metal (Cont.)	P14.C	Eggshell Latex	First Coat Second Coat Third Coat	B66310 A75 A75	ProCryl Metal Primer Solo EG Solo EG
(4)	Galvanized Metal/ Aluminum	P15.A	Flat Latex	First Coat Second Coat Third Coat	B66310 A74 A74	ProCryl Metal Primer Solo Flat Solo Flat
		P15.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B66310 A76 A76	ProCryl Metal Primer Solo SG Solo SG
		P15.C	Eggshell Latex	First Coat Second Coat Third Coat	B66310 A75 A75	ProCryl Metal Primer Solo EG Solo EG
(5)	Plaster, Concrete, Brick	P16.A	Flat Latex	First Coat Second Coat Third Coat	LX02 B30 B30	Loxon ProMar 200 Zero Flat ProMar 200 ZeroFlat
		P16.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	LX02 B31 B31	Loxon ProMar 200 Zero SG ProMar 200 Zero SG
		P16.C	Eggshell Latex	First Coat Second Coat Third Coat	LX02 B20 B20	Loxon ProMar 200 Zero EG ProMar 200 Zero EG
(6)	Concrete Block	P17.A	Flat latex	First Coat Second Coat Third Coat	B25 B30 B30	PrepRite Block Filler ProMar 200 Zero Flat ProMar 200 Zero Flat
		P17.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B25 B31 B31	PrepRite Block Filler ProMar 200 Zero SG ProMar 200 Zero SG
		P17.C	Eggshell Latex	First Coat Second Coat Third Coat	B25 B20 B20	PrepRite Block Filler ProMar 200 Zero ProMar 200 Zero
(7)	Acoustical Ceiling Tile/ Plaster	P18.A	Latex	One Coat to Cover	A21	EcoSelect
(8)	Ceramic Tile like Finishes	P19.A	Epoxy	First Coat Second Coat Third Coat	B51 B73 B73	Multi Purpose Primer PI Waterbased Epoxy PI Waterbased Epoxy

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(9)	Ceiling and Wall w/ misc. Pipes & Conduit Exposed, Trusses & Beams w/Spray-on Fire Insulation	P20.A	Latext Dry Fall	One Coat	B42	PI Waterbased Dryfall White or Black

(Exterior Paint Systems start on the following page)

B. Exterior Paint Systems:

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(1)	Plaster, Concrete	P50.A	Flat, Acrylic	First Coat Second Coat Third Coat	LX02 A6 A6	Loxon A-100 A-100
		P50.B	Low Sheen Enamel Acrylic	First Coat Second Coat Third Coat	LX02 126 126	Loxon A-100 A-100
		P50.C	Elastomeric (Smooth) 5 year labor warranty	First Coat Second Coat Third Coat (Spray App.)	LX02 CF12C F12	Loxon Masonry Primer Conflex XL Conflex XL
		P50.D	Elastomeric (Medium Aggregate) 5 year labor warranty	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
(2)	Concrete Block Masonry	P51.A	Flat, acrylic emulsion	First Coat Second Coat Third Coat	B25 A6 A6	PrepRite Block Filler A-100 A-100
		P51.B	Elastomeric Smooth 5 year labor warranty	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
		P51.C	Elastomeric (Medium Aggregate) 5 year labor warranty	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
		P51.D	Elastomeric (Coarse Aggregate)	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
		P51.E	Clear Water Repellent 10 year Warranty	1 Coat	LX31	Loxon 40% Water Repellant (A31T40)
(3)	Wood	P53.A	Flat Acrylic Emulsion	First Coat Second Coat Third Coat	B42 A6 A6	Exterior Wood Primer A-100 A-100
		P53.B	Semi-Gloss Acrylic	First Coat Second Coat Third Coat	B42 A76 A76	Exterior Wood Primer Solo SG Solo SG
		P53.C	Low Sheen Enamel Acrylic	First Coat Second Coat Third Coat	B42 A75 A75	Exterior Wood Primer Solo LS Solo LS

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(3) (Cont.)	Wood	P53.D	Flat, Stain, Water Base, Semi-Transp.	First Coat Second Coat	A15T A15T	Deckscapes ST Stain Deckscapes ST Stain (A15T00215)
		P53.E	Flat, Stain Opaque	First Coat Second Coat	A6 A6	A100 A100
		P53.F	Varnish Clear Gloss	First Coat Second Coat Third Coat	6509 6509 6509	McCloskey's Spar McCloskey's Spar McCloskey`s Spar
		P53.G	Stain and Varnish	First Coat Second Coat Third Coat	 6509 6509	Aqua Seal McCloskey's McCloskey's
(4)	Ferrous Metal	P55.D	Gloss, High Perform.	First Coat Second Coat Third Coat	646 B65 B65	Macropoxy Epoxy Acrolon 100 Acrolon 100
		P55.E	Semi-Gloss High Perform.	First Coat Second Coat Third Coat	B66-310 B66 B66	ProCryl Primer Pro Ind DTM Acrylic Pro Ind DTM Acrylic
(5)	Galv. Metal & Aluminum	P56.A	Gloss	First Coat Second Coat Third Coat	B66-310 A77 A77	ProCryl Primer Solo GL Solo GL
		P56.B	Flat, Acrylic	First Coat Second Coat Third Coat	B66-310 A74 A74	ProCryl Primer Solo Flat Solo Flat
		P56.C	Semi-Gloss Enamel Acrylic	First Coat Second Coat Third Coat	B66-310 B53 B53	ProCryl Primer PI WB Urethan Enamel PI WB Urethan Enamel
		P56.D	Gloss	First Coat Second Coat Third Coat	B66-310 A77 A77	ProCryl Primer Solo GL Solo GL
		P56.E	Semi Gloss	First Coat Second Coat Third Coat	B66-310 A76 A76	ProCryl Primer Solo S/G SoloS/G
(6)	Galv. Metal & Aluminum	P57.C	Gloss High Perform.	First Coat Second Coat Third Coat	646 B65 B65	Marcopoxy Epoxy Acrolon 100 High Gloss Acrolon 100 High Gloss
	High Perf.	P57.D	Semi-Gloss High Perform.	First Coat Second Coat Third Coat	B71Y1 B66 B66	DTM Wash Primer Pro Ind DTM Acrylic Pro Ind DTM Acrylic

END OF SECTION

SECTION 099623
GRAFFITI-RESISTANT COATINGS

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 graffiti resistant coatings, surface preparation, and the application on the concrete masonry unit (CMU) exterior substrates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements, application instructions and indicate VOC content.

B. Samples for Verification: Provide four (4) sample units as follows:

1. Submit Samples on concrete masonry units (CMU) or face shells, 8 inch by 16 inch minimum face size. Contractor to provide CMU matching those specified for the project.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 EXTRA MATERIALS

A. Graffiti Cleaner: Furnish to Owner two 1-gallon containers of graffiti cleaner products upon completion of the Project.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer of coating materials and shall be a firm with not less than three years of successful experience in application of coatings of type required on substrates similar to those of this project.

B. Mockups: Prepare mockup of coating system on each type of substrate required to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of coating system; area of mockup to be approximately 100 sq. ft.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and/or reducing.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coating system only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply coating system in rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency and graffiti resistant properties specified within specified warranty period.

1. Warranty Period:

a. Water Repellency: Ten (10) years from date of Substantial Completion.

b. Graffiti Resistance: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

2.2 GRAFFITI-RESISTANT COATINGS

A. General: Graffiti resistant coatings shall be a clear, non-sacrificial graffiti resistant coating which provides protection for exterior vertical surfaces from permanent graffiti staining and damage caused by spray paint and marking pens. Coating shall be suitable for application to painted and unpainted surfaces including masonry, concrete, metals, cement plaster and acrylic coatings. Product shall be of type such that recoating with the underlying paint is possible without removal of the graffiti resistant coating. Product shall be a coating that dries clear, non-yellowing, with a low luster.

B. Graffiti-Resistant Coating System: Graffiti resistant coating system is comprised of coatings of three separate coating components as follows:

1. First Coat: Water repellant.
2. Second Coat: Graffiti resistant coating base coat.
3. Third Coat: Graffiti resistant coating finish coat.

C. Basis of Design: Where named products are indicated, Drawings and Specifications are based on products by the following:

1. Rainguard International.

a. Subject to compliance with requirements, provide named manufacturer products indicated or submit Request for Substitution.

D. Water Repellent: Silane/Siloxane blend penetrating water repellent, paintable.

1. Product: Rainguard International; Micro Seal™ Water Repellent.
2. Properties:

a. Material Type: Silane/Siloxane blend.
b. Active Content: 100%.
c. Solids Content by Volume: 40% or 80% depending on dilution.

d. Color: Milky white, dries clear.
e. Flash Point: Non-flammable.
f. VOC Content: 15 g/L or less.
g. Alkalinity Value (pH): Approximately 6.
h. Weight: Approximately 8.7 lbs./gal.
i. Water-Vapor Transmission: Minimum 100 percent, ASTM D 1653.
j. Water Repellency: 98.6 % effective, ASTM C 67.
k. Weathering: No change after 3,500 hours, ASTM G 53.

E. Graffiti-Resistant Coating, Base Coat: Non-sacrificial anti-graffiti coating consisting of a cross-linked co-polymer material coating that dries clear with a low-luster sheen, is non-yellowing, and is capable of protecting surfaces from graffiti defacement from commercially available spray paints.

1. Product: Rainguard International; VandIguard Five™.
2. Properties:

a. Material Type: Cross linked co-polymer.
b. Permeability: 100% permeable.
c. Solids Content by Volume: Approximately 34%.
d. Solids Content by Weight: Approximately 55%.
e. Flash Point: Non-flammable.
f. VOC Content: 20 g/L or less.

F. Graffiti-Resistant Coating, Finish Coat: Non-sacrificial anti-graffiti coating consisting of a water-based emulsion that dries clear with a matte finish and is non-yellowing. Finish coat shall only be applied over specified graffiti resistant coating base coat.

1. Product: Rainguard International; VandIguard Finish Coat™.

2. Properties:

a. Material Type: Water based blended emulsion.
b. Permeability: 100% permeable.
c. Solids Content by Volume: Approximately 28%.
d. Solids Content by Weight: Approximately 45%.
e. Flash Point: Non-flammable.
f. VOC Content: 20 g/L or less.

G. Graffiti Cleaner: Biodegradable, 100% water neutralized citrus based cleaner.

1. Product: Rainguard International; VandIClean™ Super

2. Properties:

a. Material Type: Water based blended emulsion.
b. Permeability: 100% permeable.
c. Solids Content by Volume: Approximately 28%.
d. Solids Content by Weight: Approximately 45%.
e. Flash Point: Non-flammable.
f. VOC Content: 20 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to coating system manufacturer's requirements. Check moisture content in three (3) representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of coating system.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions as applicable to substrates and systems indicated.

B. Clean substrates of substances that could impair bond of coating materials, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

D. Masonry Substrates: Remove efflorescence and chalk. Do not apply coatings if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

E. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of coating system materials. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of coating system materials being deposited on surfaces. Cover live vegetation.

F. Coordination with Sealant Joints: Do not apply coating system until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Coating system work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, coating system, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply coatings according to manufacturer's written instructions.

1. Use applicators and techniques suited for product and substrate indicated.
2. Apply each coat at not less than the manufacturer's published application rate, approximate application rates indicated below, verify application rates with manufacturer’s published application rates.

a. First Coat, Water Repellant:

1) Concrete: 125 to 150 sf/gallon.
2) CMU: 50 to 70 sf/gallon.
3) Cement Plaster: 100 to 150 sf/gallon.

b. Second Coat, Graffiti Resistant Coating Base Coat:

1) Concrete: 225 to 250 sf/gallon.
2) CMU: 180 to 200 sf/gallon.
3) Cement Plaster: 200 to 250 sf/gallon.

c. Third Coat, Graffiti Resistant Coating Finish Coat:

1) Concrete: 250 to 270 sf/gallon.
2) CMU: 200 to 220 sf/gallon.
3) Cement Plaster: 220 to 270 sf/gallon.

C. Surfaces to be Coated: Apply graffiti resistant coating system to the following exterior surfaces:

1. Concrete masonry unit site fencing.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a manufacturer-authorized technical service representative to inspect and approve the substrate before application, to instruct the applicator on the product and application method to be used, and to field test the in-place surfaces after application.

B. Manufacturer's representative shall inspect substrate conditions including alkalinity and moisture content. Obtain written approval from representative before proceeding with work.

C. Water Repellant Testing: Test water repellant application prior to application of graffiti resistant coatings in accordance with manufacturer's instructions and as follows:

1. Water Spray Test: After water repellent has dried, spray coated surfaces with water. After surfaces have adequately dried, recoat surfaces that show water absorption.
2. Water Uptake Test: Perform a RILEM Water Uptake test on a minimum of 10 locations on the completed project to confirm conformance to minimum results stated in Part 1 hereinbefore. Conduct test on upper and lower portions of the masonry surfaces and on an equal number of joints and block surfaces. Tests shall be conducted by the manufacturer’s representative.
3. Furnish written certification that surface preparation and rate of application is completed in accordance with specification requirements and the manufacturer’s recommendations. Furnish results of in-place RILEM and spray test.

D. Verify application rate by periodic on-site inspection and calculation of area covered compared to consumption of coating material used. Document inspections showing total area covered and number and volume of coating containers used.

3.5 CLEANING AND PROTECTION

A. Immediately clean coating materials from adjoining surfaces and surfaces soiled or damaged by coating system application as work progresses. Correct damage to work of other trades caused by coating system application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

END OF SECTION

SECTION 101100
VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic laminate panel visual display surfaces.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
2. Include electrical characteristics for motorized units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints.
3. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.

D. Product Schedule: For visual display units.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display surfaces completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index450 or less.

2.2 VISUAL DISPLAY SURFACE PANELS

A. Visual Display Surface Panels: Factory-high-pressure magnetic markerboard laminate panel of three-ply construction, consisting of backing, core material, and high-pressure markerboard laminate writing surface.

B. Panel Size: Size as indicated on Drawings, 60 inch width by length required.

C. Markerboard Laminate: Magnetic high-pressure markerboard plastic laminate complying with physical testing requirements of NEMA LD 3.

1. Basis of Design: Panolam; Pionite or Nevamar.

a. Subject to compliance with requirements, provide the product indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”

2. Color: White.

D. Core: One of the following panel products containing no urea formaldehyde:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

E. Edge Construction: Square, plastic laminate edged.

F. Mounting: Adhered to substrate.

2.3 ACCESSORY MATERIALS

A. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

1. Comply with VOC requirements of authorities having jurisdiction.

B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section “Painting” and recommended in writing by visual display unit manufacturer for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display surfaces as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Install marker board surface panels in accordance with manufacturer's written instructions.

B. Adhere panels to wall substrate. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

C. Keep perimeter lines straight, level, and plumb.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION

SECTION 101400
SIGNAGE

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. Interior and exterior panel signs for room or space identification.

B. Related Sections:

1. Division 01 Section “Temporary Facilities and Controls” for Project identification signage.
2. Division 10 Section “Dimensional Sign Characters” for individual character signs.
3. Division 22, 23, and 26 Sections as applicable to Plumbing, Mechanical, and Electrical Work for tags and nameplates for equipment.
4. Division 32 Section “Paving Specialties” for parking lot and pedestrian signage.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and full-scale template layout of characters and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, and Braille layout.

C. Schedule: Schedule indicating sign locations, type, other pertinent data, and referenced to rooms or doors with the same referencing as used on the Drawings.

D. Braille Text Certification: Provide certification from the sign manufacturer that Braille text complies with regulatory requirements indicated (Contracted (Grade 2) per 2019 CBC Section 11B-703.3).

E. Braille Text Translation Confirmation: Provide confirmation of Braille text translations.

F. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for each type of sign and material indicated.

G. Samples for Verification: Provide 2 full size sample signs showing edge and corner condition, border, text characters of height specified, Braille text, and selected colors, of each type of sign indicated. Sample will be retained by Architect.

H. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

1.5 FIELD CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to replace signs that fail in materials or workmanship within specified warranty period.

1. Damage from deliberate destruction and vandalism is excluded.
2. Warranty Period for Interior Signs: Building lifetime.
3. Warranty Period for Exterior Signs: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS FOR SIGNS

A. Regulatory Requirements: Comply with requirements of the following:

1. 2010 ADA Standards for Accessible Design.
2. ANSI A117.1.
3. 2019 California Building Code, Sections 11B-216 and 11B-703.

B. Room or Space Identification Signs, CBC 11B-216.2: Where provided, signs identifying permanent rooms and spaces shall comply with CBC Sections 11B-703.1, 11B-703.2, 11B-703.3, and 11B-703.5. Where pictograms are provided as designations of permanent rooms and spaces, the pictograms shall comply with CBC Section 11B-703.6 and shall have text descriptors complying with CBC Sections 11B-703.2 and

11B-703.5. Exterior signs that are not located at the door to the space they serve shall not be required to comply with CBC Section 11B-703.2.

C. Directional and Informational Signs, CBC 11B-216.3: Signs that provide direction to or information about spaces and facilities shall comply with CBC Section 11B-703.5.

D. Means of Egress Signs, CBC 11B-216.4: Tactile exit signs required by CBC Section 1013.4 at doors to exit passageways, exit discharge, and exit stairways shall comply with CBC Sections 11B-703.1, 11B-703.2, 11B-703.3, and 11B-703.5.

E. Inspection, CBC 11B-703.1.1.2: Signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per Chapter 1, Division II, Section 111, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with the regulations of CBC Section 11B-703.

F. Raised Characters, CBC 11B-703.2: Raised characters shall comply with CBC Section 11B-703.2 and shall be duplicated in Braille complying with CBC Section 11B-703.3. Raised characters shall be installed in accordance with CBC 11B-703.4.

1. Depth: Raised characters shall be raised 1/32-inch minimum above their background.
2. Case: Raised characters shall be upper case.
3. Style: Raised characters shall be sans serif. Characters shall not be italic, oblique, script, highly decorative, or other unusual forms.
4. Character Proportions: Raised characters (Text) on signs shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.
5. Character Height: Character height measured vertically from the baseline of the character shall be of 5/8-inch minimum and 2-inches maximum based on the height of the uppercase letter “I”.
6. Stroke Thickness: Stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character.
7. Character Spacing: Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8 inch minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8 inch minimum and 4 times the raised character ma stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch minimum.
8. Line Spacing: Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.
9. Format: Text shall be in a horizontal format.

10. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background. Requirement applies to all signs.

G. Braille, CBC 11B-703.3: Braille shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4.

1. Dimensions and Capitalization (CBC 11B-703.3.1): Braille dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms. Braille dot physical requirements shall be per CBC Table 11B-703.3.1 as indicated below; dimensions for distances are measured from center to center of Braille dots:

   a. Dot Base Diameter: 0.059 inch minimum, 0.063 inch maximum.
   b. Distance between Two Dots in the same Cell: 0.100 inches.
   c. Distance between corresponding Dots in adjacent Cells: 0.300 inches.
   d. Dot Height: 0.025 inch minimum, 0.037 inch maximum.
   e. Distance between corresponding Dots from one cell directly below: 0.395 inch minimum, 0.400 inch maximum.

2. Position (CBC 11B-703.3.2): Braille shall be positioned below the corresponding text in a horizontal format, flush left, or centered. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated 3/8 inch minimum and 1/2 inch maximum from any other tactile characters and 3/8 inch minimum and from raised borders and decorative elements.

H. Sign Installation Height and Location, CBC 11B-703.4:

1. Height Above Ground or Floor: Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches maximum above the finish floor or ground surface, measured form the baseline of the highest line of raised characters.
2. Location: Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. Where provided, signs identifying permanent rooms and spaces shall be located at the entrance to, and outside of the room or space. Where provided, signs identifying exits shall be located at the exit door when approached in the direction of egress travel.

I. Visual Characters, CBC 11B-703.5: Visual characters are considered to be intended for signage that is not accompanied by Braille. (The requirements of this Section do not apply to room identification signage).

1. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background. Requirement applies to all signs.
2. Case: Characters shall be upper case or lower case or a combination of both.
3. Style: Characters shall be conventional in style. Characters shall not be italic, oblique, script, highly decorative, or other unusual forms.
4. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.
5. Character Height: Minimum character height shall be based on the uppercase letter “I” and shall comply with CBC Table 11B-703.5.5 as follows:

    a. Height of baseline of character from finish floor:

        1) 40 inches minimum to less than or equal to 70 inches with a horizontal viewing distance of:

            a) Less than 72 inches: Minimum character height to be 5/8 inch.
            b) 72 inches and Greater: Minimum character height to be 5/8 inch plus 1/8 inch for each foot of viewing distance beyond 72 inches.

        2) Greater than 70 inches to less than or equal to 120 inches with a horizontal viewing distance of:

            a) Less than 180 inches: Minimum character height to be 2 inches.
            b) 180 inches and Greater: Minimum character height to be 2 inches plus 1/8 inch for each foot of viewing distance beyond 180 inches.

        3) Greater than 120 inches, with a horizontal viewing distance of:

            a) Less than 21 feet: Minimum character height to be 3 inches.
            b) 21 feet and Greater: Minimum character height to be 3 inches plus 1/8 inch for each foot of viewing distance beyond 21 feet.

6. Height from Finish Floor or Ground: Visual characters shall be 40 inches minimum above the finish floor or ground measured to the baseline of the character.
7. Stroke Thickness: Stroke thickness of the uppercase letter “I” shall be 10 percent minimum and 20 percent maximum of the height of the character.
8. Character Spacing: Character spacing shall be measured between the two closest points of adjacent raised characters, excluding word spaces. Spaces between individual characters shall be 10 percent minimum and 35 percent maximum of character height.

9. Line Spacing: Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.
10. Format: Text shall be in a horizontal format.

J. Pictograms, CBC 11B-703.6:

1. Pictogram Field: Pictograms shall have a field height of 6 inches minimum. Characters and Braille shall not be located in the pictogram field.
2. Finish and Contrast: Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.
3. Text Descriptors: Pictograms shall have text descriptors located directly below the pictogram field. Text descriptors shall comply with CBC Sections 11B-703.2, 11B-703.3, and 11B-703.4.

K. Symbols of Accessibility, CBC 11B-703.7:

1. Finish and Contrast: Symbols of accessibility and their background shall have a non-glare finish. Symbols of accessibility shall contrast with their background with either a light symbol on a dark background or a dark symbol on a light background.
2. Symbols:

   a. International Symbol of Accessibility (ISA): ISA symbols shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.
   b. International Symbol of Teletypewriter (TTY): The International Symbol of Teletypewriter (TTY) shall comply with CBC Figure 11B-703.7.2.2.
   c. Volume Control Telephones: Telephones with a volume control shall be identified with a pictogram complying with CBC Figure 11B-703.7.2.3.
   d. Assistive Listening Systems: Assistive listening systems shall be identified by the International Symbol of Access for Hearing loss complying with CBC Figure 11B-703.7.2.4.
   e. Toilet and Bathing Facilities, Geometric Symbols: Doorways leading to toilet and bathing rooms shall be identified by a geometric symbol complying with CBC Section 11B-703.7.2.6. The symbol shall be mounted at 58 inches minimum and 60 inches maximum above the finish floor measured from the centerline of the symbol. Where a door is provided, the symbol shall be mounted within 1 inch of the vertical centerline of the door.

      1) Men’s Toilet and Bathing Facilities: Men’s toilet and bathing facilities shall be identified by an equilateral triangle, 1/4 inch thick, with edges 12 inches long and a vertex pointing upward. The triangle symbol shall contrast with the door, either light on dark background or dark on a light background.
      2) Women’s Toilet and Bathing Facilities: Women’s toilet and bathing facilities shall be identified by a circle, 1/4 inch thick and 12 inches in diameter. The circle symbol shall contrast with the door, either light on dark background or dark on a light background.

3) Unisex Toilet and Bathing Facilities: Unisex toilet and bathing facilities shall be identified by a circle, 1/4 inch thick and 12 inches in diameter with a 1/4 inch thick triangle with a vertex pointing upward superimposed on the circle and within the 12 inch diameter. The triangle symbol shall contrast with the circle symbol, either light on dark background or dark on a light background, the circle symbol shall contrast with the door, either light on dark background or dark on a light background.
4) Edges and Corners: Edges of geometric symbols shall be rounded, chamfered, or eased. Corners of geometric symbols shall have a minimum radius of 1/8 inch.

2.2 MANUFACTURERS

A. Manufacturers, Basis-of-Design Products: In other Articles where named manufacturer's products are indicated, Drawings and Specifications are based on products manufactured by:

1. Best Sign Systems Inc.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) ASI-Modulex, Inc.
2) Gemini Incorporated.

2.3 PANEL SIGNS

A. General: Provide smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally from corner to corner complying with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Design Requirements: Panel signs shall comply with Part 2 Article "Regulatory Requirements for Signs."

C. Scheduled Signs: Provide signs as indicated on Drawings and as scheduled in Part 3 Article "Sign Schedule."

D. Interior Panel Signs: Basis of Design: Best Sign Systems, Inc., HC 300 Series signs complying with the following requirements:

1. Material: Best Sign Systems Inc., MP Plastic, phenolic-backed melamine plastic laminate faced sheet, 0.25-inch thick.
2. Edge Condition: Beveled.
3. Corner Condition: Rounded to radius of 1/2 inch.
4. Text Font: Standard Medium.
5. Text Height: As indicated on Drawings.
6. Mounting: Unframed, wall mounted.

7. Color: As selected by Architect from manufacturer's full range, text and border shall contrast with background.

E. Exterior Panel Signs: Basis of Design: Best Sign Systems, Inc., HC 300 Series signs complying with the following requirements:

1. Material: Fiberglass Sheet, 0.25-inch thick.
2. Edge Condition: Beveled.
3. Corner Condition: Rounded to radius of 1/2 inch.
4. Border: 3/8-inch wide.
5. Text Font: Standard Medium
6. Text Height: As indicated on Drawings.
7. Mounting: Unframed, wall mounted.
8. Color: As selected by Architect from manufacturer's full range, text and border shall contrast with background.

F. Sign Backs/Blanks: Provide matching sign blanks for signs mounted to transparent and/or semi-transparent glazed surfaces to conceal exposed sign backs.

1. Where sign backs/blanks are located within the interior of the building, signs shall be of the same material as other interior signs.
2. Where sign backs/blanks are located on the exterior of the building, signs shall be of the same material as other exterior signs.
3. Profile and size of sign backs/blanks shall match that of the sign backs that are to be concealed.

2.4 ACCESSORIES

A. Mechanical Fasteners: Use tamper resistant fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

B. Adhesives: As recommended by sign manufacturer and with a 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).

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and with sign surfaces free from distortion and other defects in appearance.
2. Install signs at locations required by regulatory requirements, as indicated on the Drawings, and per this Specification section.

B. Height: Install signs at heights indicated on Drawings and to comply with regulatory requirements indicated in Part 2 Article “Regulatory Requirements for Signs” of this specification Section.

1. Sign mounting height shall be consistent for the Project.

C. Location Relative to Door Openings: Install signs relative to door openings as indicated on Drawings and to comply with regulatory requirements indicated in Part 2 Article “Regulatory Requirements for Signs” of this specification Section.

1. Sign location relative to door openings shall be consistent for the Project.

D. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces that cannot be drilled or screwed. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
3. Mechanical Fasteners: Use non-removable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
4. Where panel signs are mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

B. Clean per manufacturer’s recommendation prior to final inspection.

3.4 SIGN SCHEDULE

A. Interior Room Identification Signs: Provide interior room identification signage adjacent to doors as indicated on Drawings.

1. Text Content: Identify rooms by number and name unless otherwise indicated. Room names and numbering shall comply with Owner's instructions (not Architect's referencing or numbering as indicated on the Drawings).
2. Text Height: As indicated on Drawings and in compliance with referenced CBC and ADA requirements.
3. Sign Size: As indicated on drawings.

B. Tactile Exit Signs: Provide tactile exit signs at locations indicated on Drawings, as required to comply with regulatory requirements, and as follows:

1. Exterior Doors: Each grade level exterior exit door from a room or space having an illuminated exit sign shall be identified by a tactile exit sign with the word "EXIT".
2. Interior Rooms to Exits: Each exit door to a corridor, exit enclosure, or exit passageway, from a room having an illuminated exit sign shall be identified by a tactile exit sign with the words "EXIT ROUTE".

C. Toilet Room Identification Signs: Signage shall consist of door mounted geometric symbols and wall mounted identification signs to comply with regulatory requirements and as indicated on the Drawings.

D. Exterior Room/Space Identification Signs: Provide exterior identification signage at exterior public access doors to each usable or occupied space of the building.

1. Text Content: Identify building areas by functional use. Text content shall comply with Owner's instructions.
2. Text Height: As indicated on Drawings and in compliance with referenced CBC and ADA requirements.
3. Sign Size: As indicated on drawings.

END OF SECTION

SECTION 101405
DIMENSIONAL SIGN CHARACTERS

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 cast aluminum dimensional sign characters.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale layout of characters and other components. Show mounting methods, layout, spacing, reinforcement, accessories, and installation details.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: Dimensional characters, full-size sample of each type of dimensional character for material, finish, color, size, and mounting indicated.

E. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain dimensional characters through one source from a single manufacturer.

1.5 FIELD CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate location of backing for dimensional character anchorage with wall framing.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. 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.

1. Manufacturer: Subject to compliance with requirements, provide products manufactured by one of the following:

   a. ASI-Modulex, Inc.
   b. Gemini Incorporated.
   c. Metal Arts; Div. of L&H Mfg. Co.

2. Character Material: Aluminum.
3. Character Finish: Clear anodized.
4. Character Height: As indicated on Drawings.
5. Text Style: As selected by Architect from manufacturer’s standard font styles.
6. Text/Message: As indicated on Drawings.
7. Mounting: Concealed studs, noncorroding for substrates encountered.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. 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.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish nonferrous-metal or stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners, Concealed Studs: Concealed (blind), threaded studs screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.5 ALUMINUM 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

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

3.2 INSTALLATION

A. General: Locate characters where indicated on Drawings, install characters using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Provide paper template showing proper character layout spacing and connection points for installation.

C. Mounting Method: Concealed studs; using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

3.3 CLEANING AND PROTECTION

A. Remove and replace damaged or deformed characters that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 102113
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:

1. Solid-polymer plastic toilet compartments configured as toilet enclosures and urinal screens; floor anchored and overhead braced.

B. Related Sections:

1. Division 05 Section “Cold Formed Metal Framing” and/or 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 plumbing fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication and indicate measurements on Shop Drawings.

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 2019 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. Clear 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. Wheelchair Accessible Urinals: Screens at wheelchair accessible urinals shall provide 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. 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.

H. 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.

I. 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 2019 CBC Section 1209.3.2:

   a. Bottom of Screen from Floor: 12 inches maximum.
   b. Top of Screen from Floor: 60 inches minimum.
   c. Projection from Wall: 18 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 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. Stainless steel corner guards.

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 impact-resistant 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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

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 and metal finishes 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, U-shaped 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 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M.

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. 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.

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. Custodial accessories.
3. Underlavatory 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 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.

1.5 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) 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 2019 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 shall not obstruct the use of grab bars for a minimum distance of 12 inches above, 1-1/2 inches below, and/or 1-1/2 inches from the ends of grab bars.
5. Accessories located below 34 inches above the floor shall not project into the clear space required for any plumbing fixture.
6. Accessories with their bottom edge more than 27 inches above the floor shall not project more than 4 inches from the wall.
7. 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.

8. Toilet paper dispensers shall not be of a type that controls delivery or that does not allow for continuous paper flow.

2.2 TOILET ROOM ACCESSORIES

A. Source Limitations: Obtain toilet room accessories from a single source from a single manufacturer.

B. Scheduled Accessories: Toilet room accessories shall be as scheduled on the Drawings.

1. Basis of Design: Named 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)

C. 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.

D. Finish: Exposed stainless steel surfaces of accessories shall have a satin finish unless otherwise indicated.

2.3 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Basis-of-Design Product: Drawings and Specifications are based on the following:

a. Truebro, Inc., 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. Description: Antimicrobial, white molded-plastic underlavatory guard assemblies. Underlavatory 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.

3. Locations: Provide underlavatory 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.

2.4 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.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

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.

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.

END OF SECTION

SECTION 104116
EMERGENCY KEY CABINETS (KNOX BOX)

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 emergency key cabinets (Knox Box).

1.3 SUBMITTALS

A. Product Data: For each type of product including installation instructions. Include roughing-in dimensions and details showing mounting method and relationships of box and trim to surrounding construction.

PART 2 - PRODUCTS

2.1 EMERGENCY KEY CABINETS

A. Emergency Key Cabinets, General: Emergency key cabinet for secure storage of keys for use by local police and fire departments. Emergency key cabinets shall be acceptable to local police and fire departments.

B. Basis of Design: Drawings and Specifications are based on the following:

1. Knox Company; 3200 Series Hinged Door Model Knox Box.

C. Emergency Key Cabinet Properties:

1. Mounting:

   a. Masonry Walls: Surface mounted.
   b. Framed Walls: Recessed mounted (7 inch by 7 inch mounting flange).

2. Exterior Dimensions (Body): 4 inches high, by 5 inches wide, by 3-3/4 inches deep.
3. Lock: UL listed, double action rotating tumblers and hardened steel pins accessed by a biased cut key.
4. Body: 1/4 inch steel plate.
5. Door: 1/2 inch thick steel with interior gasket and stainless steel hinge.

6. Finish: Manufacturer's standard proprietary finish, color black.
7. Capacity: Holds up to 10 keys and access cards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls for suitable framing depth and blocking where emergency key cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for recessed emergency key cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. Location and Height: Install emergency key cabinets in locations and at mounting heights indicated, 6 ft high minimum mounting height unless restricted by local requirements; mounting locations and heights shall be acceptable to authorities having jurisdiction.

B. Installation: Install cabinets in accordance with cabinet manufacturer's installation instructions appropriate for construction materials of project conditions. Installation shall be capable of resisting physical attack and preventing unwanted removal of cabinet.

3.4 ADJUSTING AND 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 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 manufacturers.

END OF SECTION

SECTION 104415
FIRE EXTINGUISHERS 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. Non-fire rated fire extinguisher cabinets for portable fire extinguishers.
2. Portable hand carried fire extinguishers.

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 fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire extinguisher cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

C. Coordinate blocking and backing for wall anchorage of cabinets with wall framing.

1.5 WARRANTY

A. Special Warranty for Fire Extinguishers: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
   b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from a single source from a single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. J. L. Industries, Inc.; a division of Activar Construction Products Group.
2. Larsen's Manufacturing Company.
3. Potter Roemer LLC.

2.2 PORTABLE FIRE EXTINGUISHERS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers, General: Type, size, and capacity as indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated, with monoammonium phosphate-based dry chemical in enameled-steel container, minimum size as follows:

1. Administrative areas and standard classrooms: 2A:10B:C, 5-lb nominal capacity.
2. Vocational Classrooms/Shops: 4A:80B:C, 10-lb nominal capacity

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with black] baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

2.4 FIRE EXTINGUISHER CABINETS

A. Cabinet Type: Semi-recessed cabinet with box partially recessed in walls of sufficient depth suitable for fire extinguishers 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: Cold-rolled steel sheet.
3. Wall Recess: Cabinet shall require of wall recess of no more than 4 inches.

B. Doors and Trim:

1. Trim Style: Rolled edge trim with 1-1/2-inch or 2-1/2-inch backbend depth as standard with manufacturer.

a. Projection from Wall: Cabinet, including trim and pull handles, shall not project more than 4 inches from the finished wall surface.

2. Material (Doors and Trim): Cold-rolled steel sheet.
3. Doors:

a. Style: Vertical duo panel with frame, duo panel adjacent to strike edge of door.
b. Door Glazing: Tempered float glass (clear).
c. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1) Latch and Pull: Manufacturer’s standard projecting door pull and friction latch.
2) Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3) Hinge: Manufacturer’s standard continuous hinge, of same material and finish as trim permitting door to open 180 degrees.

C. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

D. Identification: Identify fire extinguishers in fire protection cabinets with the words “FIRE EXTINGUISHER” applied to the door.

1. Lettering shall comply with authorities having jurisdiction for letter style, size, spacing, and location.
2. Lettering Application Process: Silk screened or pressure sensitive vinyl letters.
3. Lettering Color: Red.
4. Lettering Orientation: Vertical.

E. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

a. Finish: Manufacturer’s standard baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: White.

2. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet, clear anodic finish.
3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.5 FABRICATION OF FIRE PROTECTION CABINETS

A. Fire Protection 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.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS FOR CABINETS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire extinguishers, cabinets, and mounting brackets in locations indicated, and in compliance with requirements of authorities having jurisdiction.

B. Fire Extinguisher Cabinets: Fasten cabinets to structure, square and plumb.

1. Mounting Brackets: Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
2. Mounting Height: Mount cabinets and brackets so that the top of installed fire extinguishers will not exceed 48 inches above the finished floor.

C. Bracket Mounted Fire Extinguishers: Fasten mounting brackets to surfaces, square and plumb.

1. Mounting Height: Mount brackets so that the top of installed fire extinguishers will not exceed 48 inches above the finished floor, and the bottom of extinguishers will not be more than 26-1/2 inches above the floor.

D. Identification: Apply identification lettering at locations indicated or as required by authorities having jurisdiction.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 110113
OWNER FURNISHED CONTRACTOR INSTALLED 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. Contractor installation of Owner furnished equipment and appliances, including building utility service connections. Owner furnished Contractor installed equipment and appliances shall be as indicated on the Drawings.

    a. The Work shall include receiving, unloading, handling, storing, protecting, and installing Owner-furnished equipment and appliances, and making building services connections.

B. Related Sections:

1. Division 22 through 26 Sections for applicable Plumbing, Mechanical, and Electrical requirements for work relating to the installation of equipment.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Installation and materials for installation shall comply with the following:

1. NFPA 54, "National Fuel Gas Code."
2. NFPA 70, "National Electrical Code."
3. California Code of Regulations (CCR), Title 24 as follows:

    a. Part 2, California Building Code.
    b. Part 3, California Electrical Code.
    c. Part 4, California Mechanical Code.
    d. Part 5, California Plumbing Code.
    e. Part 9, California Fire Code.

1.4 COORDINATION

A. Coordinate equipment layout and installation with other work, including plumbing and electrical connections, and locations and requirements of utility service connections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and hardware for installation of equipment and appliances as recommended by equipment and/or appliance manufacturers, and as required for a complete and operational installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, utility connections, and other conditions affecting installation and performance of residential appliances.

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

3.2 INSTALLATION, GENERAL

A. General: Obtain and comply with equipment manufacturer's written installation instructions.

B. Install equipment with operational and maintenance clearances that comply with equipment manufacturer's written installation instructions and with requirements.

C. Place units in final locations after finishes have been completed in each area.

D. Connect equipment and appliances to building service utilities in compliance with plumbing, mechanical, and electrical requirements.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. Perform visual, mechanical, and electrical inspection and testing for each equipment installation according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test for Plumbing Connections: After installation, test for leaks. Repair leaks and retest until no leaks exist.

END OF SECTION

SECTION 111100
SHOP 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 shop equipment as indicated on the drawings.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for concrete work associated with shop equipment.
2. Division 05 Section "Metal Fabrications" for metal fabrications associated with shop equipment.
3. Division 22 Sections as applicable to Plumbing Work associated with shop equipment.
4. Division 26 Sections as applicable to Electrical Work for electrical wiring and connections associated with shop 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 shop equipment. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For shop equipment. 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. Qualification Data: For qualified Installer.

D. Operation and Maintenance Data: For vehicle service equipment to include in operation and maintenance manuals.

E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturers' authorized representatives who are trained and approved for installation of shop equipment required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review required testing, inspecting, and certifying procedures.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with loading dock equipment, including recessed pit dimensions, slopes of driveways, and heights of loading docks, by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 SHOP EQUIPMENT

A. Shop equipment shall be as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of shop equipment.

B. Examine roughing-in for electrical systems for equipment to verify actual locations of connections before equipment installation.

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

3.2 PREPARATION

A. Coordinate size and location of equipment to be attached to concrete and furnish anchoring devices with templates, diagrams, and instructions for their installation.

3.3 INSTALLATION

A. General: Install shop equipment in compliance with manufacturer's written installation instructions and as detailed on Drawings.

B. Install shop equipment, controls, wiring, safety devices, and accessories as required for a complete installation.

C. Rough-in electrical connections according to requirements specified in Division 26 Sections for electrical work.

3.4 TESTING AND ADJUSTING

A. Test and adjust shop equipment to function smoothly and safely, and lubricate as recommended by manufacturer.

B. Test electrical components and connections are required by applicable Division 26 Electrical Specification requirements.

3.5 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative from each equipment manufacturer to train Owner's maintenance personnel to adjust, operate, and maintain shop equipment.

END OF SECTION

SECTION 115216
PROJECTOR MOUNTS

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. Projector mounts and accessories.

B. Related Sections:

1. Division 26 Sections for electrical service and connections including device boxes for switches and control wiring.

1.3 SUBMITTALS

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

B. Shop Drawings: Show layouts and types of projection screens. Include the following:

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain projector mounts from a single source and from a single manufacturer.

1.5 COORDINATION

A. Coordinate layout and installation of projector mounts with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and wall and ceiling framing.

PART 2 - PRODUCTS

2.1 PROJECTOR MOUNTS

A. Projector Mounts: Universal low profile ceiling projector mount with four double jointed support arms with adjustable leveling feet; projector mount designed for connection to a 1-1/2 inch NPT male thread.

1. Basis of Design: Design, Drawings, and Specifications are based the following:

   a. Premier Mounts; Model PDS-PLUS Low Profile Universal Project Mount.

      1) Subject to compliance with requirements, provide product indicated or submit request for substitution per Division 01 Section "Substitution Procedures."

2. Weight Capacity: 75 lbs maximum.
3. Height: 6-1/2 inches nominal.
4. Support Connection: 1-1/2 inch National Pipe Thread (NPT).
5. Pitch: +/- 16.5 degrees.
6. Roll: +/- 7.5 degrees.
7. Yaw: 360 degrees.
8. Color: Black.

PART 3 - EXECUTION

3.1 PROJECTOR MOUNT INSTALLATION

A. Install project mount and accessories in accordance with manufacturer's written installation instructions and as indicated on the Drawings.

1. Projector mount support plate assemblies shall be laterally braced with a set of four diagonal wires with turnbuckles connected to the support plate and the structure above.

END OF SECTION

SECTION 122413
ROLLER WINDOW SHADES

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 roller shades with single rollers.

B. Related Requirements:

1. Division 05 Section "Cold Formed Metal Framing" for metal framing for mounting roller shades and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples for Initial Selection: For each type and color of shadeband material.

D. Product Schedule: For roller shades.

E. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.5 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.

1.6 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. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Roller Shades, General: Manually operated roller shades with single rollers as follows:

1. Operation: Manual with endless chain operation.
2. Mounting: Outside of jamb installation.
3. Fabric: Light Blocking.

B. Manufacturer:

1. Subject to compliance with requirements, provide roller window shades by one of the following:

a. Draper, Inc.
b. MechoShade Systems, Inc.
c. Roll-A-Shade.

2. Source Limitations: Obtain roller shades from single source from single manufacturer.

C. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

   a. Provide for shadebands that weigh more than 10lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

F. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

G. Shadeband Material: Light-blocking fabric, stain and fade resistant.

1. Source: By or recommended by Roller shade manufacturer.
2. Type/Materiual: Acrylic (60%) polyester (40%).
3. Thickness: 0.021 inches thick.
4. Weight: 14.75 oz/square yard.
5. Color: As selected by Architect from manufacturer's full range.

6. Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
7. Bacteria and Fungal Resistance: ASTM E 2180, ASTM G 21, ASTM G 22, AATCC30 Part 3, ASTM D 3273, GREENGUARD Mold and Bacteria Standard ASTM 6329; includes Microban antimicrobial additives.
8. Environmental Certification: Certified to UL GREENGUARD and GREENGUARD Gold standards for low chemical emissions into indoor air during product usage.
9. Safe for Use: RoHS/Directive 2002/95/EC, US Consumer Product Safety Commission Section 101, ANSI/WCMA A 100.1-2007 for lead content and REACH (EC 1907/2006) compliant.

H. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

2.2 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate without battens or seams to extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

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

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 133423
PREFABRICATED CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Permanent prefabricated concrete structures for utility buildings including transportation and placement.; extent of Prefabricated Concrete Structures is indicated on Drawings and specified herein.
2. Delegated design submittal.

B. Related Sections:

1. Division 01 Section “Quality and Testing Requirements” for quality assurance and testing requirements not specified in this Section.
2. Division 08 Section “Hollow Metal Doors and Frames” for hollow metal door and frame requirements.
3. Division 08 Section “Door Hardware” for door hardware requirements.
4. Division 26 Electrical Sections as applicable to power and lighting requirements.
5. Division 31 Earthwork Sections as applicable to site clearing, earth moving, and trenching.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for all specified materials, products, fixtures, and equipment to Architect for verification of conformance with requirements.

B. Samples: For all products or materials involving choices of color, pattern, or texture; submit manufacturer’s full range of color samples or actual samples where feasible, for selection by Owner.

C. Delegated-Design Submittal/Governing Agency Approval: Project is under the jurisdiction of the California Division of the State Architect (DSA), manufacturer shall submit a delegated design submittal which must be approved by DSA prior to the start of construction.

1. Submittal shall include necessary drawings, plans, elevations, sections, details of modular buildings, fabrication and installation requirements, anchorage details, and structural calculations prepared, stamped, and signed by a structural engineer licensed in the State of California. The manufacturer shall be responsible for the

design and engineering calculations, the drawings, and for responding to and resolving any comments or issues generated by DSA.

2. The Delegated Design Submittal shall be submitted to the Architect, and the Architect will transmit the submittal to the Division of the State Architect.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of precast concrete structure or manufacturer's authorized representative who is trained and approved for installation of units required for this Project who has completed successfully at least five installations of similar size and complexity within the past three years.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Factory Inspection: Inspection of in-plant work or an approved quality control program conducted by an independent agency shall be provided as required by DSA and other agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design precast concrete structure, including comprehensive engineering analysis, by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Disabled Access Requirements: Building is exempt from disabled access requirements per California Building Code Section 11B-203.5; building is for use as a utility equipment building and accessed only by service personnel.

C. Governing Codes: All work and materials shall comply with the requirements of California Code of Regulations Title 24, 2019 Editions (including supplements) of Parts 1-6, Part 11 – California Green Building Standards Code, regulations of the State Fire Marshal, and any other applicable state or local laws, ordinances, and regulations (as required for permanent construction).

D. Structural Performance: Prefabricated concrete structures shall withstand loads and stresses within limits and under conditions indicated in accordance with ASCE/SEI 7, as indicated on the Structural Drawings, and as follows:

1. Floor Loads:

a. Live Load: 100 psf.
b. Dead Load: 100 psf

2. Roof Loads:

   a. Live Load: 20 psf.
   b. Snow Load: NA, 0 psf.
   c. Dead Load: 100 psf

3. Wind Loads:

   a. Risk Category: IV.
   b. Wind Speed: 104 mph.
   c. Exposure: C.
   d. Internal Pressure Coefficient: =/-0.18.

E. Seismic Performance: Prefabricated concrete structures shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and as follows:

1. Risk Category: IV.
2. Importance Factor: 1.5.
3. Site Classification: D.

F. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with the California Electrical Code and marked for intended location and application.

G. Construction: Single story, concrete slab on grade building as follows:

1. Walls and roof construction of not less than 1-hour fire resistance rated construction (Ref. NFPA 20, Section 4.14.1.1.2).
2. Fully sprinklered in accordance with NFPA 13 as an Extra Hazard Group 2 occupancy (Ref. NFPA 20, Section 4.14.1.3).
3. Floors shall slope to provide drainage away from critical equipment (Ref. NFPA 20, Section 4.14.7.1). The pump room shall be provided with a floor drain that discharges to a frost free location (Ref. NFPA 20, Section 4.14.7.2).
4. Emergency lighting shall be provided, refer to “Electrical” paragraph and requirements under Part 2 Article “Products and Materials” (Ref. NFPA 20, Section 4.14.4 – 4.14.5.4).
5. Heating shall be provided to maintain the temperature of the pump room above 40 deg. F (Ref. NFPA 20, Section 4.14.3).
6. Ventilation shall be provided (Ref. NFPA 20, Section 4.14.6).

2.2 PRODUCTS AND MATERIALS

A. Prefabricated Concrete Structures: Provide prefabricated precast concrete structures, complete and ready for use, of configuration indicated on Drawings, and as herein specified.

B. Concrete: Steel-reinforced, 5000 PSI minimum 28-day compressive strength, air-entrained (ASTM C260).

1. Concrete Finishes:

a. Floors: Smooth trowel finish.
b. Exterior Walls: Smooth form finish.
c. Interior Walls: Smooth trowel finish.
d. Roof Surface: Manufacturer's standard cast roof finish.

C. Reinforcing Steel: ASTM A615, grade 60 unless otherwise specified.

1. Welded Wire Fabric: ASTM 185 Grade 65.

D. Post-tensioning Strand: 0.50 inch, 270 KSI Seven-Wire strand, enclosed within a greased plastic sheath (ASTM A416).

E. Sealant: Silicone sealant complying with Division 07 Section "Sealants."

1. Acceptable Product: Dow Corning 790, color matching concrete panels.
2. All joints between panels shall be caulked on the exterior and interior surface of the joints. Exterior caulk reveal to be 3/8"x 3/4" deep so that sides of the joint are parallel for proper caulk adhesion. Back of the joint to be taped with bond breaking tape or filled with backer rod to ensure adhesion of caulk to parallel sides of joint and not the back.

F. Vents: Structure manufacturer's standard metal vents of galvanized steel or aluminum; size as indicated on Drawings or as required for project conditions.

G. Panel Connections: All panels shall be securely fastened together with 3/8 inch thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A36 and hot dipped galvanized after fabrication. All fasteners to be 1/2 inch diameter bolts complying with ASTM A325 for carbon steel bolts.

1. All cast-in anchors and inserts for corner connections shall be secured directly to form before casting panels. No floating-in of connection inserts or anchors shall be allowed. Cast-in anchors used for panel connections to be Dayton-Superior F-63 coil inserts, or equal.

H. Doors and Frames: Doors and frames shall comply with Division 08 Section "Hollow Metal Doors and Frames" and with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100) and as herein specified. All door and frame galvanizing shall be in accordance with ASTM A924 and A653, A60 minimum coating thickness.

1. Doors and frames shall meet SDI standard Level 2, 1-3/4 inch thick heavy duty.
2. Doors: 1-3/4 inch thick insulated hollow metal doors; 36 inch x 80 inch minimum size; 18 gauge galvanized steel faces; inverted channel flush top cap; 12 gauge flat astragal shall be applied the exterior face of the active leaf of pairs of doors.
3. Frames: 16 gauge hollow metal frames of galvanized steel, width to match wall thickness.

4. Finish: Doors and frames shall be factory bonderized and painted with one coat of rust inhibitive primer and one finish coat of enamel paint; color to be selected by architect.

I. Door Hardware: Door hardware shall comply with Division 08 Section “Door Hardware” and as follows:

1. Pull Handle: Comply with ANSI A156.2, pull shall be thru bolt attached and constructed of a minimum 3/4 inch diameter stainless pull handle sized 8 inches center to center with a stainless backer plate, minimum 0.053” on both sides.

   a. Manufacturer: Ives.

2. Hinges: Comply with ANSI A156.1, ball bearing, non-removable pin type (3 per door minimum). Hinges shall be 4.5 x 4.5 inch, stainless steel with brushed finish.

   a. Manufacturer: Ives.

3. Deadbolt: Commercial Grade Deadbolt conforming to ANSI 156.5 furnished with a 2-1/4 inch face plate and a 1 inch projecting deadbolt with hardened steel pins. Dead bolts shall be UL. Finish shall be US26D (626) brushed chrome finish.

   a. Manufacturer: Schlage.

4. Surface Bolt: 8 inch surface bolt, UL listed, finish US26D (626) brushed chrome finish, top and bottom bolts at inactive leaf of pairs of doors.

   a. Manufacturer: Ives.

5. Threshold: Bumper Seal type threshold with a maximum 1” rise to prevent water intrusion.

   a. Manufacturer: Pemko, National Guard Products, or Zero International.

6. Overhead Door Stop-Holder: Heavy duty surface mounted hold open device with hold open/stop angle of 85 to 110 degrees. Construction shall be stainless steel. Finish US32D (630) satin stainless steel finish.

   a. Manufacturer: Glynn-Johnson.

7. Drip Cap: Aluminum drip cap with minimum projection of 2-1/2 inches.

   a. Manufacturer: Pemko, National Guard Products, or Zero International.

J. Electrical: Provide electrical conduit, outlets, wire, and switches, transformers, panelboards, fixtures, lamps, services, and appurtenances, including wiring and electrical connections to HVAC and plumbing equipment in compliance with applicable Division 26 Electrical Specification requirements.

1. Building power and lighting systems shall comply with the 2019 California Electrical Code and 2019 California Energy Code. Provide all compliance forms as required by code.

2. Interior Lighting: Surface mounted LED fixtures capable of providing an illumination level of 50 foot-candles at desk level.
3. Exterior Lighting: Surface mounted LED fixtures, fixtures shall have emergency battery backup to provide no less than 90 minutes of egress illumination where required per the California Building Code.
4. Receptacles shall be 20A and shall be GFCI type where required by Code. Cover plates shall be metal.
5. Emergency lighting shall be provided, emergency lighting shall have an intensity of illumination in the pump room of not less than 3.0 ft-candles; emergency lighting shall be capable of maintaining the lighting level for a minimum of 2 hours; emergency lighting shall not be connected to an engine starting battery (Ref. NFPA 20, Section 4.14.4 – 4.14.5.4)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before installation proceeds, survey elevations and locations of bearing surfaces for compliance with requirements and manufacturer's tolerances.

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

3.2 SITE ACCESS

A. Provide a level, unobstructed area large enough for a crane and a tractor-trailer to park adjacent to the pad. Crane must be able to place outriggers within 5 feet of edge of pad; truck and crane must be able to get side by side under their own power. No overhead lines may be within 75 foot radius of center of pad. Firm roadbed with turns that allow a 65 foot lowbed tractor-trailer shall be provided directly to the site. No building shall be placed closer than 2 feet to an existing structure unless specifically permitted.

3.3 INSTALLATION

A. Prepare substrate in compliance with requirements of Division 31 Sections applicable to site clearing, earthwork, and trenching; with structure manufacturer’s recommendations; and with requirements of the geotechnical report for the project.

B. Structure shall bear fully on a crushed stone base that is at least two feet larger than the length and width of building.

1. Crushed stone base shall be a minimum of 4 inches thick and shall be applied over compacted subgrade. The vertical soil capacity under stone shall be compacted to have minimum bearing of 1,500 pounds per square foot. Crushed stone shall be

3/8 inch or smaller and must be screeded level within 1/4 inch in both directions. Crushed stone shall be placed within a perimeter form with flat and level top edge for screeding. Forming material shall remain around stone until after the building is set.

2. The crushed stone base shall be kept within the confines of the soil or perimeter form. Do not allow the base to become unconfined so that it may wash, erode, or otherwise be undermined.

    a. If building is placed on pavement or a concrete slab, substrate below pavement or slab must have a vertical soil capacity of 1,500 pounds per square foot. Ensure bearing surface for building is flat and level. As required, place adequate material (stone or sand) to 1 inch above highest point of area where building will be placed and at least 1 foot wide all around the building footprint. Retain stone or sand with a perimeter form to prevent the material from washing out.

C. Install structures on prepared substrate plumb and level.

D. Provide positive drainage for the fill, pad or slab as required.

END OF SECTION

SECTION 210517
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION 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. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

B. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
3. Sealing Elements: High-temperature-silicone interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: 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

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 (25-mm) 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 (50 mm) above finished floor level.

3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

E. Cut sleeves to length for mounting flush with both surfaces.

1. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

F. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Use silicone sealant to seal around the outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. 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.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. 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.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant, to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Steel pipe sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
   b. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
   c. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
   d. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
   b. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
   c. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
   d. Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Steel pipe sleeves.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

FOR BID ONLY

SECTION 210518
ESCUTCHEONS FOR FIRE-SUPPRESSION 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.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. BrassCraft Manufacturing Co.
2. Dearborn Brass
3. Jones Stephens Corp.
4. Kennedy Manufacturing Company
5. Mid-America Fittings, Inc.
6. ProFlo

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

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 piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece steel or split-plate steel with polished, chrome-plated finish.
c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain:

   a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   f. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

   1. New Piping: One-piece, floor plate.
   2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 210518

SECTION 210523
GENERAL-DUTY VALVES FOR FIRE PROTECTION 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. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

1.3 DEFINITIONS

A. NRS: Non-rising stem.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

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, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

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 operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed for Fire Protection in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.
2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 (DN 50) and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers:

1. Victaulic Co. of America.
2. Nibco Inc.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 (DN 25) through NPS 2 (DN 50): Threaded ends.
12. End Connections for Valves NPS 2-1/2 (DN 65): Grooved ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers:

1) Milwaukee Valve Company
2) Globe Fire Sprinkler Corp.
3) Fivalco, Inc.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig (1200 kPa).
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze, Stainless steel, or with EPDM coating.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 (DN 25) through NPS 2 (DN 50): Threaded ends.
10. Ends Connections for Valves NPS 2-1/2 (DN 65): Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers:

1. Victaulic Co. of America.
2. Anvil International, Inc.
3. NIBCO Inc.
4. Globe Fire Sprinkler Corp.
5. Kennedy Valve Company
6. Tyco Fire Products LP
7. Fivalco Inc.
8. Zurn Industries, LLC

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

2.5 CHECK VALVES

A. Manufacturers:

1. Victaulic Co. of America.
2. Viking Corporation
3. Anvil International, Inc.
4. NIBCO Inc.
5. Reliable Automatic Sprinkler Co., Inc
6. Globe Fire Sprinkler Corporation
7. Kennedy Valve Company
8. Tyco Fire Products LP
9. Fivalco Inc.
10. Zurn Industries, LLC

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers:

1. Milwaukee Valve Company
2. NIBCO Inc.
3. United Brass Works, Inc.
4. Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

A. Manufacturers:

1. Victaulic Co. of America.
2. NIBCO Inc.
3. Kennedy Valve Company
4. WATTS
5. Mueller Co
6. Hammond Valve
7. American Cast Iron Pipe Company
8. Clow Valve Company
9. Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.8 NRS GATE VALVES

A. Manufacturers:

1. Victaulic Co. of America.
2. NIBCO Inc.
3. Kennedy Valve Company
4. Mueller Co
5. American Cast Iron Pipe Company
6. Clow Valve Company
7. Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.

9. End Connections: Flanged or Grooved.

2.9 INDICATOR POSTS

A. Manufacturers:

1. NIBCO Inc.
2. Kennedy Valve Company
3. Mueller Co
4. American Cast Iron Pipe Company
5. Clow Valve Company

B. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Type: Underground, Pit or Wall.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Wrench.

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers:
2. Victaulic Co. of America.
3. NIBCO Inc.
4. Milwaukee Valve Company
5. WATTS
6. Potter Roemer LLC
7. Tyco Fire Products LP
8. Fire Protection Products, Inc
9. Zurn Industries, LLC
10. Fire-End & Croker Corporation
11. Red White Valve Corp.

B. Description:

1. Pressure Rating: 175 psig (1200 kPa.
2. Body Design: Two piece.
3. Body Material: Forged brass or bronze.
4. Port size: Full or standard.
5. Seats: PTFE.
6. Stem: Bronze or stainless steel.
7. Ball: Chrome-plated brass.
8. Actuator: Handlever.
9. End Connections for Valves NPS 1 (DN 25) through NPS 2-1/2 (DN 65): Threaded or Grooved ends

C. Angle Valves:

1. Manufacturers

a. NIBCO Inc.
b. United Brass Works, Inc.
c. Fire Protection Products, Inc

2. Description:

a. Pressure Rating: 175 psig (1200 kPa).
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

D. Globe Valves:

1. Manufacturers

a. NIBCO Inc.
b. United Brass Works, Inc

2. Description:

a. Pressure Rating: 175 psig (1200 kPa).
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

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 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523

SECTION 210529
HANGERS AND SUPPORTS FOR FIRE SUPPRESSION 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.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. 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. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression 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.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Copper Pipe and Tube Hangers:

1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers:

   a. Unitstrut
   b. B-Line
   c. Flex-Strut Inc.
   d. G-Strut
   e. Haydon Corporation
   f. Thomas & Betts Corporation
   g. Wesanco, 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, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers:

   a. Anvil International
   b. Carpenter & Paterson, Inc
   c. Empire Industries, Inc
   d. ERICO International Corporation
   e. PHD Manufacturing, 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, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Select for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.5 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers:

a. Carpenter & Paterson, Inc
b. Clement Support Services
c. ERICO International Corporation
d. National Pipe Hanger Corporation
e. Pipe Shields Inc.
f. Piping Technology & Products, Inc
g. Rilco Manufacturing Co., Inc
h. Value Engineered Products, Inc

B. Insulation-Insert Material: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi (688-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved 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.

1. Manufacturers:

a. Hilti, Inc
b. ITW Ramset/Red Head
c. MTK Fastening, LLC
d. Simpson Strong-Tie Co., Inc

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line
b. Empire Tool and Manufacturing Co., Inc
c. Hilti, Inc.
d. ITW Ramset/Red Head
e. MTK Fastening, LLC

2. Indoor Applications: Zinc-coated or Stainless steel.
3. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M).

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

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 (90 kg).

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 strut 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 (100 mm) 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. Install in accordance with approvals and listings.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

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 (DN 65) 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 (DN 100) and larger if pipe is installed on rollers.

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. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 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.

3.4 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.

3.5 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 (40 mm).

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements 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 finishes.

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 attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. 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 (DN 15 to DN 750).
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) 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 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Comply with NFPA requirements.

L. Building Attachments: Comply with NFPA requirements. 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. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Comply with NFPA requirements. 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.

N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

SECTION 210553
IDENTIFICATION FOR FIRE-SUPPRESSION 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.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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 and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers:

a. Brady Corporation
b. Brimar Industries, Inc
c. Carlton Industries, LP
d. Champion America

e. Craftmark Pipe Markers
f. Emedco
g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc
j. Seton Identification Products

2. Material and Thickness: Brass, 0.032 inch (0.8 mm), stainless steel, 0.025 inch (0.64 mm), aluminum, 0.032 inch (0.8 mm), or anodized aluminum, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
3. Letter Color: Red
4. Background Color: White
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers:

a. Brady Corporation
b. Brimar Industries, Inc
c. Carlton Industries, LP
d. Champion America
e. Craftmark Pipe Markers
f. Emedco
g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc
j. Seton Identification Products

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) or 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.
3. Letter Color: Red
4. Background Color: White
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
7. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing

distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. 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) and 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. Manufacturers:

1. Brady Corporation
2. Brimar Industries, Inc
3. Carlton Industries, LP
4. Champion America
5. Craftmark Pipe Markers
6. Emedco
7. LEM Products Inc.
8. Marking Services, Inc
9. National Marker Company
10. Seton Identification Products
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.

C. Letter Color: Red

D. Background Color: White

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

G. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers:

1. Actioncraft Products, Inc.
2. Brady Corporation
3. Brimar Industries, Inc
4. Carlton Industries, LP
5. Champion America
6. Craftmark Pipe Markers
7. Emedco
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services, Inc
11. Seton Identification Products

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. 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: Size letters according to ASME A13.1 for piping.

F. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.4 STENCILS

A. Stencils for Piping:

1. Manufacturers:

   a. Brimar Industries, Inc
   b. Carlton Industries, LP
   c. Champion America
   d. Craftmark Pipe Markers
   e. Kolbi Pipe Marker Co.
   f. Marking Services, Inc

2. Lettering Size: Size letters according to ASME A13.1 for piping.
3. Stencil Material: Aluminum, Brass, Fiberboard, or Metal.
4. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Manufacturers:

   a. Actioncraft Products, Inc
   b. Brady Corporation
   c. Brimar Industries, Inc
   d. Carlton Industries, LP
   e. Champion America
   f. Craftmark Pipe Markers
   g. Emedco
   h. Kolbi Pipe Marker Co.
   i. LEM Products Inc.
   j. Marking Services, Inc
   k. Seton Identification Products

B. Description: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping-system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032 inch (0.8 mm) or stainless steel, 0.025 inch (0.64 mm) thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass or Steel wire-link chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

1. Manufacturers:

   a. Brady Corporation
   b. Brimar Industries, Inc
   c. Carlton Industries, LP
   d. Champion America
   e. Craftmark Pipe Markers
   f. Emedco
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc
   j. Seton Identification Products

B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Pipe-Label Locations: 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. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Fire-Suppression Standpipe: 1-1/2 inches (38 mm), round.
b. Wet-Pipe Sprinkler System: 1-1/2 inches (38 mm), round.
c. Dry-Pipe Sprinkler System: 1-1/2 inches (38 mm), round.

d. Foam-Water System: 1-1/2 inches (38 mm), round.
e. Clean-Agent Fire-Extinguishing System: 1-1/2 inches (38 mm), round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

SECTION 211119
FIRE DEPARTMENT CONNECTIONS

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. Exposed-type fire-department connections.
2. Flush-type fire-department connections.
3. Yard-type fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers:

1. American Fire Hose & Cabinet
2. Elkhart Brass Mfg. Co.
3. Fire Protection Products, Inc.
4. Fire-End & Croker Corporation
5. GMR International Equipment Corporation
6. Guardian Fire Equipment, Inc.
7. Venus Fire Protection Ltd.
8. Wilson & Cousins Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig (1200 kPa) minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Two

K. Escutcheon Plate Marking: Similar to "AUTO SPKR"

L. Finish: Polished chrome plated.

M. Outlet Size: NPS 6 (DN 150)

2.2 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers:

1. American Fire Hose & Cabinet
2. Elkhart Brass Mfg. Co.
3. GMR International Equipment Corporation
4. Guardian Fire Equipment, Inc.
5. Potter Roemer LLC
6. Venus Fire Protection Ltd.

B. Standard: UL 405.

C. Type: Flush, for wall mounting.

D. Pressure Rating: 175 psig (1200 kPa) minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Rectangular, brass, wall type.

I. Outlet: With pipe threads.

J. Body Style: Horizontal.

K. Number of Inlets: Two.

L. Outlet Location: Back.

M. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE"

N. Finish: Polished chrome plated.

O. Outlet Size: NPS 6 (DN 150).

2.3 YARD-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers:

1. Elkhart Brass Mfg. Co.
2. Fire Protection Products, Inc.
3. Fire-End & Croker Corporation
4. GMR International Equipment Corporation
5. Guardian Fire Equipment, Inc.
6. Potter Roemer LLC
7. Wilson & Cousins Inc.

B. Standard: UL 405.

C. Type: Exposed, freestanding.

D. Pressure Rating: 300 psig (2070 kPa)

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, floor type.

I. Outlet: Bottom, with pipe threads.

J. Number of Inlets: Two

K. Sleeve: Brass

L. Sleeve Height: 18 inches (460 mm).

M. Escutcheon Plate Marking: Similar to "AUTO SPKR"

N. Finish, Including Sleeve: Polished chrome plated.

O. Outlet Size: NPS 6 (DN 150).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

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

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."

C. Install two protective pipe bollards on sides of each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 211119

SECTION 211313
WET-PIPE SPRINKLER 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. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include the following:

a. Lighting fixtures.
b. Air outlets and inlets.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than three days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13 2016 Edition with State of California Amendments.
2. 2019 California Fire Code

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. High-Pressure Piping System Component: Listed for 300-psig working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Provide fire-hydrant flow test record showing the following conditions:

   a. Date.
   b. Time.
   c. Performed by.
   d. Location of Residual Fire Hydrant R.
   e. Location of Flow Fire Hydrant F.
   f. Static Pressure at Residual Fire Hydrant R.
   g. Measured Flow at Flow Fire Hydrant F.
   h. Residual Pressure at Residual Fire Hydrant R.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

   a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   b. Sprinkler Occupancy Hazard Classifications:

      1) Building Service Areas: Ordinary Hazard, Group 1.
      2) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      3) General Storage Areas: Ordinary Hazard, Group 1.
      4) Libraries except Stack Areas: Light Hazard.
      5) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      6) Office and Public Areas: Light Hazard
      7) Classroom Areas: Light Hazard.
      8) Chemistry Lab: Ordinary Hazard, Group 2
      9) Fire Pump Room/Building: Extra Hazard, Group 2.

3. Minimum Density for Automatic-Sprinkler Piping Design:

   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
   e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
   f. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Maximum Protection Area per Sprinkler:

   a. Office Spaces: 225 sq. ft..
   b. Storage Areas: 130 sq. ft..

c. Mechanical Equipment Rooms: 130 sq. ft..
d. Electrical Equipment Rooms: 130 sq. ft..
e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized- and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

F. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.

a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers:
   a. Victualic Company
   b. Anvil International
   c. Corcoran Piping Systems Co.
   d. National Fittings, Inc
   e. Shurjoint Piping Products USA Inc
   f. Smith-Copper International
   g. Tyco Fire Products LP

2. Pressure Rating: 175-psig minimum.
3. Galvanized or Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

L. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers:

   a. Victualic Company

2.3 COVER SYSTEM FOR SPRINKLER PIPING

1. Manufacturers:

   a. DecoShield Systems, Inc.

B. Description: System of support brackets and covers made to protect sprinkler piping.

C. Brackets: Glass-reinforced nylon.

D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
2. High-Pressure Piping Specialty Valves: 300-psig.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers:

   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

G. Deluge Valves:

1. Manufacturers:

   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc

2. Standard: UL 260.
3. Design: Hydraulically operated, differential-pressure type.
4. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
5. Wet, Pilot-Line Trim Set: Include gage to read diaphragm-chamber pressure and manual control station for manual operation of deluge valve, and connection for actuation device.

H. Automatic (Ball Drip) Drain Valves:

1. Manufacturers:

   a. Reliable Automatic Sprinkler Co., Inc
   b. Tyco Fire Products LP

2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.

6. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers:

   a. Victualic Company
   b. Reliable Automatic Sprinkler Co., Inc
   c. Tyco Fire Products LP

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers:

   a. Potter Electric Signal Company, LLC
   b. Potter Roemer LLC
   c. Elkhart Brass Mfg. Co., Inc

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers:

   a. Victualic Company
   b. Viking Corporation
   c. Tyco Fire Products LP

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers:

   a. Aegis Technologies, Inc.
   b. CECA, LLC
   c. Corcoran Piping System Co.
   d. Merit Manufacturing

2. Standard: UL 1474.
3. Pressure Rating: 300 psig.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers:

   a. Victualic Company
   b. FlexHead Industries, Inc.
   c. Fivalco Inc.
   d. Gateway Tubing, Inc.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 300 psig.
5. Size: Same as connected piping, for sprinkler.

2.6 SPRINKLERS

1. Manufacturers:

    a. Victualic Company
    b. Viking Corporation
    c. Reliable Automatic Sprinkler Co., Inc

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Finishes: Chrome plated, bronze, brass, or factory painted.

H. Special Coatings: Wax and corrosion-resistant paint.

I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel or Plastic, white finish, one piece, flat.

J. Sprinkler Guards:

1. Manufacturers:

    a. Victualic Company
    b. Viking Corporation
    c. Reliable Automatic Sprinkler Co., Inc

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers:

   a. Victualic Company
   b. Viking Corporation
   c. Tyco Fire Products LP

2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Electrically Operated Alarm Bell:

1. Manufacturers:

   a. Potter Electric Signal Company LLC
   b. Notifier
   c. Fire-Lite Alarms, Inc

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 10-inch diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

D. Water-Flow Indicators:

1. Manufacturers:

   a. Viking Corporation
   b. System Sensor
   c. Potter Electric Signal Company, LLC

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Manufacturers:

a. Viking Corporation
b. System Sensor
c. Potter Electric Signal Company, LLC

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Manufacturers:

a. System Sensor
b. Potter Electric Signal Company, LLC
c. Kennedy Valve Company
d. Fire-Lite Alarms, Inc

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

2.8 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.9 PRESSURE GAGES

A. Manufacturers:

a. AGF Manufacturing, Inc.
b. AMETEK, Inc.
c. Ashcroft Inc
d. Brecco Corporation
e. WIKA Instrument Corporation

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 and California Building Code requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices and air compressors.

O. Fill sprinkler system piping with water.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. 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.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. 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.

O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 for supports.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm

connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.13 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

E. High-pressure, wet-pipe sprinkler system, NPS 4 and smaller, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

F. High-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.14 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers .
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Recessed Sprinklers: Finish as indicated on plans, with corresponding escutcheon.
3. Upright, Pendent, and Sidewall Sprinklers: Finish as indicated on plans in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

SECTION 213116
DIESEL-DRIVE, CENTRIFUGAL FIRE PUMPS

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. Multistage, split-case fire pumps with diesel-engine drive.
2. Fire-pump accessories and specialties.
3. Flowmeter systems.

B. Related Requirements:

1. Division 21 Section “Wet Pipe Sprinkler Systems” for fire sprinkler piping.
2. Division 26 Electrical sections as applicable to power connections.
3. Division 28 Fire Alarm sections as applicable to alarm connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire pump.
2. Include rated capacities, operating characteristics, certified performance test curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each fire pump.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of fire pumps.
4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
5. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For fire pumps.

1. Include design calculations for selecting vibration isolators, seismic restraints, and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of fire pump.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire pumps to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7, the California Building Code, and the site information found on the S series plans.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. Environmental Conditions:

1. Ambient Temperature: 40 to 104 deg F.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 210 feet (64 m).

C. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electrical Code, by a qualified testing agency, and marked for intended location and application.

2.2 ASSEMBLY DESCRIPTION

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Assembly Attachment to Base: Fabricate mounting base and attachment to fire-pump assembly with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when mounting base is anchored to building structure.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

D. NFPA Compliance: Comply with NFPA 20.

2.3 MULTISTAGE, SPLIT-CASE FIRE PUMPS

A. Pump:

1. Standard: UL 448, for split-case pumps for fire service.
2. Number Stages: Two.
3. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
4. Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.
5. Wear Rings: Replaceable bronze.
6. Shaft and Sleeve: Alloy-steel shaft with bronze sleeve.

    a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

7. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.

B. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.

C. Capacities and Characteristics:

1. Rated Capacity: 500 gpm.
2. Total Rated Head: 100 psig.
3. Inlet Flange: Class 125.
4. Outlet Flange: Class 125.
5. Engine Horsepower: 99 hp.
6. Engine Speed: 2100 rpm.

7. Fuel Tank Capacity: 119 gal.
8. Pump-Start, Pressure-Switch Setting: 148 psig.
9. Pump-Stop, Pressure-Switch Setting: 158 psig.

2.4 DIESEL ENGINE

A. Fuel: Fuel oil, Grade DF-2.

B. Horse Power Rating: Not less than 110 percent of maximum brake horsepower (after derating for temperature and elevation according to NFPA 20).

C. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.

D. Controls:

1. Adjustable governor.
2. Over-speed shutdown.
3. Manual reset, speed switch.
4. Instrument panel with tachometer, oil pressure gage, water temperature gage, and hour meter.

E. Fuel System:

1. Comply with NFPA 20.
2. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
3. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
4. Flexible metallic fuel lines.
5. Inline fuel filter.
6. Oil pressure safety switch.
7. Air cleaner.
8. Engine-driven oil pump.
9. Enclosed control wiring electric starter with voltage regulator.
10. Double-Wall Storage Tank: Size indicated, but not less than required by NFPA 20; with floor legs, direct-reading level gage.

F. Exhaust System:

1. Piping: ASTM A 53/A 53M, Type E or S, Schedule 40 black steel; ASME B16.9 weld-type pipe fittings; ASME B16.5 steel flanges; and ASME B16.21 nonmetallic gaskets.
2. Fabricate double-wall, ventilated thimble from steel pipe.
3. Flexible exhaust connector.
4. Industrial exhaust silencer with spark arrestor.

G. Rated Engine Speed: 2100 rpm.

H. Maximum Piston Speed for Four-Cycle Engines: 1750 fpm (533.4 m/min).

I. Engine- or Skid-Mounted Lubrication System:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

J. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system.

K. Cooling System:

1. Factory installed, closed loop, liquid cooled, with radiator factory mounted on fire-pump mounting frame and integral engine-driven coolant pump.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
3. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
4. Expansion Tank: Constructed of welded-steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure, with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

L. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.

M. Air-Intake Filter: Standard duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

N. Starting System: 12V dc, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: 3 x 15 seconds from battery 1 or 2 alternatively. 15 seconds rest in between each crank attempt.
4. Battery: Adequate capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1 wall-mounted cabinet.

2.5 FIRE-PUMP ACCESSORIES AND SPECIALTIES

A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

B. Circulation Relief Valves: UL 1478, bronze or cast iron, spring loaded; for installation in pump-discharge piping.

C. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

D. Outlet Fitting: Concentric tapered reducer at pump-discharge outlet.

E. Discharge Cone: Closed or open type.

F. Hose Valve Manifold Assembly:

1. Standard: Comply with requirements in NFPA 20.
2. Header Pipe: ASTM A 53/A 53M, Schedule 40 galvanized steel, with ends threaded according to ASME B1.20.1.
3. Header Pipe Fittings: ASME B16.4 galvanized cast-iron threaded fittings.
4. Automatic Drain Valve: Complying with UL 1726.
5. Manifold:

   a. Test Connections: Comply with UL 405, except provide outlets without clappers instead of inlets.
   b. Body: Exposed-type, brass or ductile iron, with number of outlets as required by NFPA 20.
   c. Escutcheon Plate: Brass or bronze; rectangular.
   d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
   e. Exposed Parts Finish: Rough brass.
   f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

2.6 FLOWMETER SYSTEMS

A. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.

B. Pressure Rating: 175 psig (1200 kPa) minimum.

C. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.

D. Permanently Mounted Flowmeter: Compatible with flow sensor, with dial not less than 6 inches in diameter. Include bracket or device for wall mounting.

1. Tubing Package: NPS 1/4 rubber tubing with copper or brass fittings and valves.

2.7 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Day Tank: UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:

1. Containment: Integral rupture basin, with a capacity of 150 percent of nominal capacity of day tank.

   a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.

2. Tank Capacity: As recommended by engine manufacturer 119 gallons.
3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
5. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.

C. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Capacity: Fuel for 24 hours continuous operation at 100 percent rated power output.
3. Vandal-resistant fill cap.
4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.8 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.9 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."

1. Verification of Performance: Rate fire pumps according to UL 448.

B. Fire pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.

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

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Equipment Mounting:

1. Install fire pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete"
2. Attach pumps to equipment base using anchor bolts.
3. Comply with requirements for vibration isolation and seismic control devices specified in Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

D. Support piping and pumps separately, so weight of piping does not rest on pumps.

E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Section 211313 "Wet-Pipe Sprinkler Systems."

F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Section 211313 "Wet-Pipe Sprinkler Systems."

G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

H. Install fuel system according to NFPA 20.

I. Install water supply and drain piping for diesel-engine heat exchangers. Extend drain piping from heat exchangers to point of disposal.

J. Install exhaust-system piping for diesel engines. Extend to point of termination outside structure. Install pipe and fittings with welded joints; install components having flanged connections with gasketed joints.

K. Install condensate-drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system to condensate traps and to point of disposal.

L. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

M. Electrical Wiring: Install electrical devices furnished by equipment manufacturers that are not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

N. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 211313 "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect flowmeter-system meters, sensors, and valves to tubing.

E. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
2. Test according to NFPA 20 for acceptance and performance testing.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

G. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform or Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train or Train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213116

SECTION 220000
GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The preceding General Conditions shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall also apply to Division 22 of these Specifications and shall be considered a part of that Divisions.

1.2 CODES AND REGULATIONS

A. All work and materials shall be in accordance with current rules and regulations of applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:

California Building Code	CCR Title 24, Part 2
California Electrical Code	CCR Title 24, Part 3
California Mechanical Code	CCR Title 24, Part 4
California Plumbing Code	CCR Title 24, Part 5
California Energy Code	CCR Title 24, Part 6
California Fire Code	CCR Title 24, Part 9
Local Codes	

1.3 DEFINITIONS

A. Provide: The term "provide" as used in these specifications or on the drawings shall mean furnish and install.

B. Piping: The term "piping" as used in these specifications or on the drawings shall mean all pipe, fittings, valves, hangers, insulation, etc. as may be required for a complete and functional system.

C. Ductwork: The terms "duct" or "ductwork" as used in these specifications or on the drawings shall mean all ducts, fittings, joints, dampers, hangers, insulation, etc. as may be required for a complete and functional system.

D. Wiring: The term "wiring" as used in these specifications or on the drawings shall mean all wiring, conduit, boxes, connections, transformers, relays, switches etc. as may be required for a complete and functional system.

1.4 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work.

1.5 COORDINATION OF WORK

A. Examination: Before starting work, thoroughly examine existing and newly completed underlying and adjoining work and conditions on which the installation of this work depends. Report to the Engineer in writing all conditions which might adversely affect this work.

B. Layout: Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements.

C. Verification: If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination. Verify the proper voltage and phase of all equipment with the electrical plans.

D. Location of Utilities Prior to Trenching or Earthwork: The Contractor shall notify the Owner a minimum of two business days prior to beginning trenching or earthwork. Prior to this notification, the Contractor shall have marked all proposed trenches with paint and shall have contacted a utility locating company and have had this company mark all found underground utilities with paint. The Contractor shall then coordinate and arrange for a site visit with the Owner to review the proposed trenching and/or earthwork areas. Trenching and/or earthwork shall not begin until the Owner agrees. Repair and/or compensation for repair of marked utilities is the responsibility of the Contractor. The Owner retains the right to either self-perform the repair or require the Contractor to complete the repair, as directed by the Owner. If while performing the work, the Contractor discovers utilities that have not been marked, the Contractor shall immediately notify the Owner verbally and in writing.

1.6 GUARANTEE

A. Guarantee shall be in accordance with the General Conditions. The Contractor shall repair any defects due to faulty materials or workmanship and pay for any resulting damage to other work which appears within the guarantee period. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the

certificate of guarantee shall be furnished to the Owner through the Engineer.

1.7 QUIETNESS

A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.8 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.9 EXAMINATION OF SITE

A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.10 COMPATIBILITY WITH EXISTING SYSTEMS

A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

1.11 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project acceptance. 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.

1.12 SUBMITTALS

A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material or equipment shall not be ordered or installed until written review is processed by the Engineer.

All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be

current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.

2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on drawings.

3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be high-lighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.

B. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and features desired. Proposed substitutions shall comply with the Owner's General Requirements. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, 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.

C. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

1.13 MANUFACTURER'S RECOMMENDATIONS

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 through the construction of the project.

1.14 SCHEDULING OF WORK

A. All work shall be scheduled subject to the review of the 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 contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner. HVAC equipment and functions, whether existing or new, shall be maintained in operating condition whenever the facility is occupied, unless otherwise approved by the Owner.

1.15 DEMOLITION

A. Existing equipment, ducts, piping, etc. noted for removal shall be removed and delivered to the Owner at a location to be determined by the Owner. Those items determined by the Owner to be of no value shall become the property of the Contractor and shall be removed from the job site by the Contractor at the Contractor's expense. Existing piping, ducts, services, etc. requiring capping shall be capped below floors, behind walls, above ceilings or above roof unless otherwise noted. Where items are removed, patch the surfaces to match the existing surfaces.

1.16 HAZARDOUS MATERIAL REMOVAL

A. All hazardous material removal will be by the Owner. Hazardous material is to be removed before the work is started. If the Contractor discovers hazardous material which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.17 OPENINGS, CUTTING AND PATCHING

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall be provided by other Divisions. 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 Engineer.

1.18 EXCAVATION AND BACKFILL

A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay 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. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.

B. Excavation: Width of trench at top of pipe shall be minimum of 16", plus the outside diameter of the pipe. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.

C. Backfill:

1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator.

2. One Foot Above Pipe to Grade: Material 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.

D. Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100' of trench.

1.19 CONTINUITY OF SERVICES

A. Existing services and systems shall be maintained except for short intervals when connections are made. The Contractor shall be responsible for interruptions of services and shall repair damage done to any existing service caused by the work. If utilities not indicated on the drawings are uncovered during excavation, the Contractor shall notify the Engineer immediately.

1.20 PROTECTIVE COATING FOR UNDERGROUND PIPING

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru-Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. John-Mansville. Protective coating shall be extended 6" above surrounding grade.

1.21 ACCESS DOORS

A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

1 valve up to 1-1/2”	12” x 12”
1 valve up to 3”	16” x 16”

1.22 CONCRETE ANCHORS

A. Steel stud with expansion wedge requiring a drilled hole – powder driven anchors are not acceptable. Minimum spacing shall be 12 diameters center to center and 10 diameters center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the ICC Evaluation Service Report (ESR) values. Minimum concrete embedment shall be the nominal embedment listed in the ESR table. Hilti Kwik Bolt TZ.

1.23 EQUIPMENT ANCHORING AND OTHER SUPPORTS

A. Mechanical systems (equipment, ductwork, piping, conduit, etc.) shall be anchored in accordance with the CBC. All systems mounted on concrete shall be secured with a concrete anchor at each mounting point. All air handlers shall be mounted on spring isolators. Secure base plate as indicated above. Attachment of equipment, ductwork, piping, conduit, etc. supported on curbs or platforms shall be made to the side of curbs and platforms, where possible. Where screws or lag bolts must be installed through the top of a sheet metal cap, the installation shall be as follows. Pre-drill pilot hole. Fill pilot hole with polyurethane sealant. Install screw or lag bolt with a flat washer and an EPDM washer adjacent to the sheet metal.

1.24 SUPPORTS AND SEISMIC RESTRAINTS

A. Any structural element required to hang or support piping, ducts or equipment provided under this Division and not shown on other drawings shall be provided under this Division.

B. Mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with the CBC. Submit anchorage calculations and details stamped and signed by a structural engineer registered in the State of California. Submit shop drawings showing location, type and detail of restraints. Submit manufacturer’s data for restraints. Restraint system shall be Mason West, Inc. (OSHPD OPM 0043-13).

1.25 PAINTING

A. Paint all black iron supports, hangers, anchors, etc. with two coats of rust resisting primer. Also paint all uninsulated black iron piping exposed to weather with two coats of rust resisting primer.

1.26 ROOF PENETRATIONS AND PATCHING

A. Whenever any part of the mechanical systems penetrates the roof or exterior wall, the openings shall be flashed and counter-flashed water tight with minimum 22 gauge galvanized sheet metal. Flashing shall extend not less than eight inches from the duct, pipe, or supporting member in all directions unless detailed otherwise. All roof penetrations and patching shall be in accordance with the recommendations of the National Roofing Contractor's Association and the Owner's roofing standards.

1.27 SYSTEM IDENTIFICATION

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Below Grade Piping: Bury a continuous, pre-printed, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.

C. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-4). Provide 1/2" high lettering - white on black background. Nameplates shall be permanently secured to the exterior of the unit.

D. Valves: Provide brass valve tags with brass hooks or chains on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Prepare and submit a tagged-valve schedule, listing each valve by tag number, location and piping service. Deliver to Owner through the Engineer.

1.28 CLEANING

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork,

inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.

1.29 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-3). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system. The Engineer's office shall be notified 48 hours prior to this meeting.

C. Acknowledgment: 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.

1.30 RECORD DRAWINGS

A. The Contractor shall obtain one set of prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, walks. In addition, the water, gas, sewer, under floor duct, etc. within the building shall be recorded by offset distances from building walls. An electronic copy of the original drawings will be made available to the Contractor. The Contractor shall transfer the changes, notations, etc. from the marked-up prints to the electronic copy. The record drawings (marked-up prints, electronic drawings disc and a hard copy) shall be submitted to the Engineer for review.

1.31 ACCEPTANCE TESTING

A. The Contractor shall perform, document and submit all acceptance testing as required by California Code of Regulations, Title 24, Part 6.

END OF SECTION

SECTION 220050
PLUMBING

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 Division.

1.2 GENERAL MECHANICAL PROVISIONS

A. The preceding General Mechanical Provisions shall form a part of this Division with the same force and effect as though repeated here.

1.3 SCOPE

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Sanitary sewer system.
2. Domestic water system.
3. Fuel gas system.
4. Storm drain system (including rainwater leaders).
5. Drain system (including condensate drain).
6. Compressed air system.
7. Argon and carbon dioxide system.
8. Oxygen and Acetylene system.
9. All equipment as shown or noted on the drawings or as specified.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Sanitary Sewer:

1. Soil, Waste and Vent Piping: Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings, CISPI 301, or hub end with rubber gaskets, ASTM A74, ASTM C564. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute as manufactured by Tyler, AB&I or Charlotte.

Heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C1540. Husky HD 2000, Clamp-All 80. Mission HeavyWeight MG Couplings are also acceptable. Size 2" and smaller above grade may be standard weight galvanized steel, ASTM A120/A53, with coated cast iron recessed drainage fittings, ANSI B16.12. 2" and smaller exposed to view shall be galvanized steel, ASTM A120/A53, with coated cast iron recessed drainage fittings, ANSI B16.12.

2. Cleanouts: Comparable models of Josam, Wade or Zurn are acceptable. Floor Cleanouts: Smith 4028 with nickel bronze top in finished areas; Smith 4228 in utility areas. Wall Cleanouts: Smith 4532 with stainless steel cover and screw. Pipe Cleanouts: Iron body with threaded brass plug.

3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F22 in foot traffic areas; G5 in roadways.

B. Storm Drain (Including Rain Water Leader, RWL):

1. Piping: Inside Building and Within Five Feet of Building Walls: Same as Soil, Waste and Vent Piping, except as otherwise noted on drawings. Where exposed to view on exterior of building, piping shall be galvanized steel with recessed drainage fittings.

C. Water, Natural Gas and Air:

1. Cold Water Piping:

a. Inside Building, Within Five Feet of Building Walls, and All Above Grade:

1) Schedule 40 galvanized steel pipe, ASTM A120/A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3.

-or-

2) Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, 95-5 tin-antimony solder. All nipples shall be red brass (85% copper). Above grade fittings may be copper (1/2” to 2”) or bronze (2-1/2” to 4”) press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer’s installation instructions. Nibco, ProPress.

b. Outside Building - Below Grade:

1) Same as Inside Building. Galvanized steel shall have protective coating.

-or-

2) 3" and Smaller: Schedule 40 Polyvinyl chloride (PVC) with

solvent weld fittings where approved by administrative authority.

2. Hot Water Piping:

   a. Inside Building - Above Slab: Same as Cold Water Piping - Inside Building.

   b. Outside Building or Below slab: Pre-insulated. Type L copper core. 1" foamed polyurethane insulation. Polyvinyl chloride jacket. Sealed ends. Rubber ring internal slip joint. Fittings shall be wrought copper, with brazed joints (1100F, min.). Ricwil, Thermal Pipe Systems.

3. Natural Gas Piping:

   a. Inside Building and All Above Grade: 2" and Smaller: Schedule 40 galvanized steel pipe, ASTM A120/A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Flexible connections shall be corrugated stainless steel, CSA (US) approved. 2-1/2"_and larger: Schedule 40 black steel pipe, ASTM A120/A53. Standard weight carbon steel welding fittings, long radius ells, ANSI B16.9.

   b. Inside Building - Below Grade to Five Feet Outside Building: Same as Inside Building and All Above Grade. Provide sleeves and vents acceptable to administrative authority.

   c. Outside Building - Outside Building - Below Grade: Polyethylene pipe and fittings, ANSI B31.8, ASTM D2513, where allowed by administrative authority, Driscopipe 6500, Dupont Aldyl "A", Plexco. Otherwise, piping shall be coated schedule 40 steel, ASTM A53.

4. Air Piping: Schedule 40 galvanized steel pipe, ASTM A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3.

5. Valves and Specialties:

   a. Valves:

      1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Grinnell, Milwaukee, Nibco, Stockham or Walworth are acceptable. All valves of a particular type or for a particular service shall be by the same manufacturer. Butterfly valves may be substituted for 2-1/2" and larger gate valves above grade; see specification below. Use full port ball valve for 2” and smaller water shutoff valves; see specification below.

2) Gate Valve: 2" and Smaller: All bronze. Rising stem. Union bonnet. Wedge disk. Malleable iron handwheel. 200 psi WOG. Stockham B-105. 2-1/2" and Larger: Iron body, bronze mounted. Non-rising stem. Wedge disk. 200 psi WOG. Flanged or AWWA hub end as applicable. Stockham G-612. Underground valves shall have square operating nut. Provide one operating "T" handle for underground valves.

3) Butterfly Valve: Iron threaded lug body. Aluminum bronze disk. O-ring seals. Resilient, removable seat. 416 stainless steel shaft. 6" and smaller valves shall have multi-position lever handle. 8" and larger valves shall have gear operator. Provide 2" extension neck at insulated pipes. Demco Series NE, Grinnell, Stockham

4) Check Valve: 2" and Smaller: All bronze swing check, regrinding. 200 psi WOG. Stockham B-319.

5) Ball Valve: Full port. Bronze body, cap, stem, disk and ball. Screwed connection. Lever handle. TFE seat. O-ring seals. 300 psi WOG. Apollo, Grinnell, Jomar.

6) Plug Valve: Valves in gas piping systems must be UL listed for gas distribution. 4" and Smaller: Eccentric bronze or nickel plated semi-steel plug. Semi-steel body. Bronze bushings. Buna-N-rings. 175 psi WOG. DeZurik Series 400. 1-1/2" and smaller natural gas valves may be full port ball valves. Apollo, Jomar, Grinnell.

7) Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy G5 in roadways (use B-9 for ball valves).

c. Air Control Equipment:

1) Air Filter: 5 micron oil-water-dirt filter. Replaceable oil absorbing element. Centrifugal air pattern to extend element life. Quick disconnect clear bowl with metal bowl guard. Manual drain. Size for 5 psi (max.) pressure drop. Provide two extra elements. Wilkerson F20, 30, 40.

2) Air Pressure Regulator (Pressure Reducing) Valve): Self-relieving diaphragm type. Capacity and pressure ranges to match application. Internal screen accessible through cleanout plug. Pressure gage. Wilkerson.

3) Automatic Drain: Automatic float type drain. Quick disconnect clear bowl with metal bowl guard. Internal screen.

4) Air Quick Disconnect: Ball and ring lock. Automatic check valve. Provide matching stem. DeVilbiss.

d. Miscellaneous Specialties:

1) Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.

2) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Grinnell. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. Victaulic Style 77, Type "E" gasket, Grinnell.

3) Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO.

4) Shock Absorber: Multiple bellows. Seamless copper chamber approved for concealed installations. Designed and applied in accordance with PDI WH201. Sioux Chief, Watts.

5) Flexible Connection: Corrugated bronze core covered with high tensile bronze tubular braid. 150 psi working pressure. 2" and smaller shall have screwed connections. 2-1/2" and larger shall have flanged connections. Flexonics, Keflex.

D. Drain Piping (including Condensate): Copper Type L as specified above for inside building cold water piping.

E. Oxygen and Acetylene System:

1. Piping (downstream from pressure regulator): Schedule 80 black steel pipe, ASTM A53. Extra strong carbon steel welding fittings, long radius ells, ANSI B16.9.

2. Manifold and Accessories:

a. General: All manifold equipment and accessories shall be UL listed and shall meet OSHA requirements.

b. Manifold and Cylinder Modules: All piping, fittings and valves upstream from pressure regulator shall be capable of withstanding 3000 psi for oxygen; 1000 psi for acetylene. Manifold shall be

factory prefabricated modular assemblies consisting of brass tee, extension, mounting bracket and header valve. Metal-to-metal seals. Silver soldered joints. Rego, Victor.

c. Pigtail Assembly (connection of cylinder to manifold piping): Metal-to-metal seals, silver soldered joints and integral check valves. Integral dry type flash arrestors are also required for acetylene. Material shall be rigid brass for oxygen, flexible type with stainless steel braid for acetylene. Rego, Victor.

d. Manifold Pressure Regulator: Multi-stage type with inlet and outlet gages, integral inlet filter, union nut connection, and safety relief valve. Regulator shall provide gas flow at a constant delivery pressure not to exceed 15 psi for acetylene and 100 psi for oxygen. Rego, Victor.

e. Station Pressure Regulator: Single-stage type with inlet and outlet gages, integral inlet filter, union nut connection, and safety relief valve. Regulator shall provide gas flow at a constant delivery pressure not to exceed 15 psi for acetylene and 100 psi for oxygen. Rego, Victor.

f. Shutoff Valve: Each valve shall be specifically designed for the applicable gas and pressure range. Rego, Victor.

g. Flashback Arrestor (Acetylene System): Low pressure hydraulic tank type. Floor stand or bracket with U-bolts for wall mounting. Relief valve. Tappings for inlet, outlet and drain. Rego, Victor.

F. Argon and Carbon Dioxide System:

1. Piping (downstream from pressure regulator): Schedule 80 black steel pipe, ASTM A53. Extra strong carbon steel welding fittings, long radius ells, ANSI B16.9.

2. Manifold and Accessories:

a. General: All manifold equipment and accessories shall be UL listed and shall meet OSHA requirements.

b. Manifold and Cylinder Modules: All piping, fittings and valves upstream from pressure regulator shall be capable of withstanding 3000 psi. Manifold shall be factory prefabricated modular assemblies consisting of brass tee, extension, mounting bracket and header valve. Metal-to-metal seals. Silver soldered joints. Rego, Victor.

c. Pigtail Assembly (connection of cylinder to manifold piping): Metal-to-metal seals, silver soldered joints and integral check

valves. Material shall be flexible type with stainless steel braid. Rego, Victor.

d. Manifold Pressure Regulator: Single-stage type with inlet and outlet gages, integral inlet filter, union nut connection, and safety relief valve. Regulator shall provide gas flow at a constant delivery pressure not to exceed 100 psi. Rego, Victor.

e. Station Pressure Regulator: Single-stage type with inlet and outlet gages, integral inlet filter, union nut connection, and safety relief valve. Regulator shall provide gas flow at a constant delivery pressure not to exceed 100 psi. Rego, Victor.

f. Shutoff Valve: Each valve shall be specifically designed for the applicable gas and pressure range. Rego, Victor.

G. Miscellaneous Piping Items:

1. Pipe Support:

a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Grinnell, Unistrut.

b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco, Superstrut.

c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Grinnell, Unistrut.

2. Flashing: Vent flashing shall be 4 lb/ft2 lead, 16" sq. flange, length sufficient to be turned down 2" into vent. Oatey. Flashing for other piping through roof shall be prefabricated galvanized steel roof jacks with 16" sq. flange. Provide clamp-on storm collar and seal water tight with mastic. For cold process built-up roof, material shall be 4 lb/ft^2 lead instead of galvanized steel.

2.2 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Pre-Molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 50F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes 3/4" and less; 1-1/2" thickness for pipe sizes 1" and larger. Certainteed, Knauf, Johns-Manville, Owens-Corning.

C. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 50F. 1-1/2" thickness. Knauf, Johns-Manville, Owens-Corning.

D. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.

E. Stretchable Glass Fabric: Reinforcing mesh. 10 X 20 continuous filament glass yarns per inch. Johns-Manville.

F. Vapor Barrier Coating: Childers CP-30, Foster 30-25.

G. Lagging Adhesive: Childers CP-50A, Foster 30-36.

H. Outdoor Mastic: Childers CP-21, Foster 65-05.

I. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft2-F or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.

J. Molded Closed Cell Vinyl (Piping Insulation Under Disabled Accessible Lavatories and Sinks): Fully molded closed cell vinyl, 3/16" thick. Internal ribs on drain insulation to provide air gap. Thermal conductivity shall not exceed 1.17 BTU-in/hr-ft^2-°F at an average temperature of 73°F. Weep hole in cleanout nut enclosure. Out of sight nylon fastening system. Hinged cap over valve to allow access for servicing. Truebro Lav-guard.

2.3 FIXTURES

A. General: Provide rough-in for and install all plumbing fixtures shown on drawings. Except in equipment rooms, all trim, valves and piping not concealed in wall structure, above ceiling or below floors, shall be brass with polished chrome plate finish, unless noted otherwise. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.

B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures and trim. Manufacturer's model numbers are listed to complete description. Equivalent models of American Standard, Eljer, Elkay, Haws, Kohler or T&S Brass are acceptable. For drainage fixtures, equivalent models of Josam, Smith or Zurn

are acceptable.

C. Stops and P-Traps: All fixtures shall be provided with stops and P-Traps as applicable. Wall mounted faucets, valves, etc. shall have integral stops or wall mounted stops.

1. Stops: All hot and cold water supplies shall be 1/2" I.P.S. inlet angle stops with stuffing box, loose key lock shield, and brass riser (3/8" for 2-1/2 gpm and less, otherwise 1/2"). McGuire, Speedway.

2. P-Traps: Semi-cast brass, ground joint. 17-gage. Clean-out plug. Unobstructed waterway. California Tubular, McGuire.

2.4 EQUIPMENT

A. General Requirements:

1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.

2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.

3. Ratings:

a. Electrical: Electrical equipment shall be in accordance with NEMA standards and UL or ETL listed where applicable standards have been established.

b. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be approved by AGA.

4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.

5. Electrical:

a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal

blocks for controls and interlocks not included in equipment package. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.

b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.

c. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

B. Water Heater: Gas-Fired, tankless, condensing, wall-mounted, direct-vent water heater(s) certified by ANSI Z21.10.3/CSA 4.3. Water heater(s) shall be rated for 150 PSI working pressure and 300 PSI test pressure. Unit(s) shall have steel case, stainless steel heat exchangers. Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. UL listed. Navien, Intellihot, A.O. Smith.

C. Water Heater: Gas fired, Condensing, Power-Direct Vent. Glass lined tank with magnesium anode protection. 150 psi working pressure. Fully insulated. Automatic temperature control. 100% safety shut-off. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. CSA (US) approved. A.O. Smith, Rheem, Bradford-White.

D. Circulating Pump: In-line centrifugal. Aluminum housing. All parts exposed to fluid, stainless steel. Water lubricated ceramic shaft and bearings. Epoxy encapsulated windings. Grundfos. -Or- Bronze body, brass impeller. Mechanical seals. Bronze sleeve bearings. Integral thermal overload protection. Bell and Gossett, Taco, Thrush.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by the Engineer. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as

specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Provide secondary drain piping where required.

2. Joints:

   a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.

   b. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

   c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.

   d. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards.

3. Fittings and Valves:

   a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
   b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.

   c. Unions: A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.

   d. Valves: All valves shall be full line size. Provide shut-off valve for each building and each equipment connection. Provide shut-off valve at each point of connection to existing piping. At equipment connections, valves shall be full size of upstream piping, except that gas valves within 18" of the point of connection to the equipment may be the same size as the equipment connection.

   e. Valve Accessibility: All valves shall be located so that they are easily accessible. Valves located above ceilings shall be installed

within 24" of the ceiling. Refer to specification 200000 for access requirements.

4. Pipe Support:

a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Grinnell No. 9788; nipple through surface shall be threaded brass.

1) Pressure Pipe:

Pipe Size (Inches)	Maximum Spacing* Between Supports (ft.)		
	Copper	Sch. 40 steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	10	4
1-1/2	6	10	4
2	10	10	4
2-1/2	10	10	4
3	10	10	4
4	10	10	4
6	10	10	4

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings. Plastic piping shall be supported per the manufacturer's recommendations. Seismic requirements may reduce maximum spacing.

2) Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.

b. Hot and Cold Water Piping: All hot and cold water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.

c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

5. Miscellaneous:

a. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.

b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance. Piping through walls below grade shall be sealed with Link-Seal.

c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of the fire authority having jurisdiction.

d. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

e. Thermometer or Pressure Gage Tap: Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1-1/2".

f. Exposed Pipe at Fixtures: Piping extending from finished surfaces into a finished room shall be chrome plated brass, except under kitchen sinks in commercial kitchens.

B. Sanitary Sewer Piping:

1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.

2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface.

3. Vents: Vents shall terminate not less than 6" above the roof nor less than 24" from any vertical surface nor within 10' of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2' minimum from gutters, parapets, ridges and roof flashing.

C. Storm Drain (Including Rain Water Leader, RWL): Similar to Sanitary Sewer.

D. Water Piping: Connections to branches and risers shall be made from top of main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Minimum pipe size shall be 3/4", unless otherwise noted. Exposed fixture stops and flush valves shall be installed with brass nipples for copper piping and galvanized nipples for galvanized piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve. Provide shut off for each building and each connection to equipment. Shock absorbers shall be installed in a vertical position per manufacturer's instructions and per PDI-WH 201 where flush valves, metering faucets or other fast acting valves are connected to the domestic piping system. Only equipment mounted on vibration isolators shall be connected with flexible connections. Underground hot water and cold water piping which run parallel to each other shall be installed a minimum of 3 feet apart.

E. Natural Gas Piping: Installation shall comply with CPC and NFPA 54 (National Fuel Gas Code). Shall be pitched to drain to dirt legs at low points. No unions shall be installed except at connections to equipment. Provide shutoff and dirt leg at each equipment connection. Only equipment mounted on vibration isolators shall be connected with flexible connectors. Under floor piping shall be sleeved and vented. Underground Polyethylene pipe and butt fusion fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions. Provide 14-gage insulated tracer wire secured to pipe at 10' intervals with nylon ties. Terminate tracer 6" above grade at both ends.

F. Drain Piping (Including Condensate): Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with clean-out plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connection. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass.

G. Air Piping: Shall be pitched to drain to automatic drains or drip legs. Branch connections shall be made from top of main. Provide shutoff at each equipment connection. Connections to equipment mounted on vibration isolators shall be made with flexible connection.

H. Welding Gas Piping:

1. General: All materials, installation and testing shall be in accordance with NFPA 51. Connections to branches and risers shall be made from top of main. Provide shutoff and dirt leg (sediment trap) at each individual station regulator.

2. Cleaning: All piping shall be cleaned with a solution of 5 gallons of alkaline liquid SANASOLV 6103 per 1000 gallons of water. Provide temporary

drum, pump, and return hose to circulate solution for 2 hours minimum to remove all traces of oil, scale and oxides from all sections of piping including each drop to welding stations. At end of 2 hour period, rinse out system with cold water until neutral to Phenolphthalein test solution. Nitrogen at 80-100 psi shall be used to blow out and dry all piping before connection to oxygen or acetylene supply.

I. PVC Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

3.2 PIPING INSULATION INSTALLATION:

A. Domestic Hot Water:

1. General: All domestic hot water piping, fittings and accessories shall be insulated.

2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure sealing tape.

3. Fittings and Valves:

a. Wrap all fittings and valves with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Solvent weld. Seal all joints with factory supplied pressure sealing vapor barrier tape with 1-1/2" (min.) overlap on both sides of joint. Insulate valves to stem. Do not insulate unions, flanges or valves unless water temperature exceeds 140ºF or the piping is exposed to weather.

b. For miscellaneous fittings and accessories for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the fiberglass blanket with stretchable glass fabric, one coat of lagging adhesive and a final coat of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

4. Additional Finish for Exposed Piping and Equipment: All piping and equipment exposed to view but protected from the weather shall be given an additional finish of PVC jackets.

B. Cold Water Piping-Freeze Protection: All cold water piping exposed to weather shall be wrapped with insulating tape, 50% overlap. Cover valves to stem. Apply at least two coats of protective finish.

C. Piping Insulation Under Disabled Accessible Lavatories and Sinks: Hot and cold water piping, hot and cold water stop and drain piping under disabled accessible lavatories and sinks shall be insulated with 3/16" thick molded closed cell vinyl to prevent accidental injury due to contact or temperature extremes. Installation shall be in accordance with manufacturer's instructions. There shall be no sharp or abrasive surfaces under disabled accessible lavatories and sinks.

3.3 FIXTURE INSTALLATION

A. Fixture Height: Shall be as indicated on Architectural drawings.

B. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted to proper height to drain. Cover openings during construction to keep all foreign matter out of drain line.

C. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Lavatories shall be supported with concealed arm supports. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary 1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

D. Floor Mounted Fixtures: Shall be provided with proper support plates. Grout at the floor with waterproof ceramic tile grout.

E. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

3.4 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the equipment installer to insure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment. All equipment shall be securely anchored in place.

B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.5 TESTS AND ADJUSTMENTS

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Engineer. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new

section shall be included in the new test.

B. Gravity Systems:

1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10' above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.

2. Storm Drain (Including Rainwater leader): Similar to Sanitary Sewer.

3. Drains (Including Condensate): Similar to Sanitary Sewer.

C. Pressure Systems:

1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made.

2. Domestic Hot and Cold Water Piping: Maintain 100 psig water pressure for 4 hours.

3. Gas Piping: Maintain 100 psig air pressure for 4 hours.

4. Air Piping: Maintain 150 psig air pressure for 4 hours.

5. Welding Gas Piping: Maintain 150 psig air pressure for 4 hours. Test in accordance with CCR, Title 8. Test medium must be oil free.

3.6 DISINFECTION

A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651, "AWWA Standard for Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by a representative of the Engineer. 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 through the Engineer.

END OF SECTION

SECTION 230500
COMMON WORK RESULTS FOR HVAC

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. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.
b. Approved equivalent.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.
b. Approved equivalent.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. Approved equivalent.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.
h. Approved equivalent.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.
e. Approved equivalent.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.
e. Approved equivalent.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

   a. Calpico, Inc.
   b. Lochinvar Corp.
   c. Approved equivalent.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

   a. Perfection Corp.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Co., Inc.
   d. Victaulic Co. of America.
   e. Approved equivalent.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.
   e. Approved equivalent.

2. Sealing Elements: EPDM 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 or Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. 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, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. 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. Extend cast-

iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. 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.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2-1/2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 3 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC 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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. 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.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

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. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. 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 "Metal 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.

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: Pregalvanized 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.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. 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 stainless 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. Approved equivalent.

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.
7. Metallic Coating: Electroplated zinc or Hot-dipped galvanized.

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.
   h. Approved equivalent.

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.
10. Approved equivalent.

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.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, [**zinc-coated**] [**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, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 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.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. 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.

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. 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 trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. 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. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

K. 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.

L. 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.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. 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:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

12. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

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. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. 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 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. Isolation pads.
2. Isolation mounts.
3. Freestanding and restrained spring isolators.
4. Housed spring mounts.
5. Elastomeric hangers.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Pipe riser resilient supports.
9. Resilient pipe guides.
10. Restraining braces and cables.
11. Steel and inertia, vibration isolation equipment bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. As indicated on the construction drawings.

1.5 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Mason Industries.
4. Vibration Eliminator Co., Inc.
5. Approved equivalent.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene or rubber.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

H. 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.

I. 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.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

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.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. 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.

L. 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 reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Mason Industries.
4. Vibration Eliminator Co., Inc.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

   a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

   a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.3 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least [**four**] <**Insert number**> times the maximum seismic forces to which they will be subjected.

C. 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.

D. 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.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

F. 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.

G. 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.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. 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. Minimum length of eight times diameter.

J. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl 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.

2.4 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 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of 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 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.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:
1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. 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.

H. 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.

I. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. 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 piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Test each type and size of installed anchors and fasteners as indicated on the drawings.
   2. Test to 90 percent of rated proof load of device.
   3. Measure isolator restraint clearance.
   4. Measure isolator deflection.
   5. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 230553
IDENTIFICATION 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. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Warning tags.

1.3 SUBMITTALS

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

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-inchor 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.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. 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.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

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: Red.

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: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. 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.

2.4 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

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. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Painting."

B. 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. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Variable-air-volume systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB with a minimum of 10 years of successful testing, adjusting, and balancing experience.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's “Procedural Standards for TAB,” and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance variable-air-volume systems the same as described for constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.7 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

    a. Rooms with Multiple Supply Outlets: 0% to plus 10% of air flow rate in CFM for whole room indicated on drawings.

3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.

3. Balancing stations.
4. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches (mm), and bore.
   i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
   j. Number, make, and size of belts.
   k. Number, type, and size of filters.

2. Motor Data:

   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches (mm), and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

   a. Total air flow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Filter static-pressure differential in inches wg (Pa).
   f. Preheat-coil static-pressure differential in inches wg (Pa).
   g. Cooling-coil static-pressure differential in inches wg (Pa).
   h. Heating-coil static-pressure differential in inches wg (Pa).
   i. Outdoor airflow in cfm (L/s).
   j. Return airflow in cfm (L/s).
   k. Outdoor-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

   a. System identification.

b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Entering-water temperature in deg F (deg C).
k. Leaving-water temperature in deg F (deg C).
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig (kPa).
n. Refrigerant suction temperature in deg F (deg C).
o. Inlet steam pressure in psig (kPa).

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h (kW).
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches (mm), and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Entering-air temperature in deg F (deg C).
c. Leaving-air temperature in deg F (deg C).
d. Air temperature differential in deg F (deg C).
e. Entering-air static pressure in inches wg (Pa).
f. Leaving-air static pressure in inches wg (Pa).
g. Air static-pressure differential in inches wg (Pa).
h. Low-fire fuel input in Btu/h (kW).
i. High-fire fuel input in Btu/h (kW).
j. Manifold pressure in psig (kPa).
k. High-temperature-limit setting in deg F (deg C).
l. Operating set point in Btu/h (kW).
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h (kW).

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F (deg C).
    d. Duct static pressure in inches wg (Pa).
    e. Duct size in inches (mm).
    f. Duct area in sq. ft. (sq. m).
    g. Indicated air flow rate in cfm (L/s).
    h. Indicated velocity in fpm (m/s).
    i. Actual air flow rate in cfm (L/s).
    j. Actual average velocity in fpm (m/s).
    k. Barometric pressure in psig (Pa).

J. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.
    b. Serial number.
    c. Application.
    d. Dates of use.
    e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure water flow of at least 5 percent of terminals.
    c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    d. Verify that balancing devices are marked with final balance position.
    e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

3. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
4. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 230700
HVAC 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. Flexible elastomeric.
   b. Mineral fiber.

2. Adhesives.
3. Mastics.
4. Lagging adhesives.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Tapes.
10. Securements.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.

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 DELIVERY, STORAGE, AND HANDLING

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

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

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. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. 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, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

G. 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 III with factory-applied FSK jacket. 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. 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.

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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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. Aeroflex USA Inc.; Aeroseal.
    b. Armacell LCC; 520 Adhesive.
    c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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. 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.

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).

D. PVC Jacket Adhesive: Compatible with PVC jacket.

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. Dow Chemical Company (The); 739, Dow Silicone.
    b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    c. P.I.C. Plastics, Inc.; Welding Adhesive.
    d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 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.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

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. 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.

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.

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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, 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.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.

3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

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. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

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. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

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. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto PVC Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

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. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    d. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   b. Compac Corp.; 110 and 111.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
   d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
   b. Compac Corp.; 130.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
   d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.

6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

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. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. 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 [2 inches] [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 duct and 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.

3.4 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. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 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 and Valves:

1. Install insulation over fittings and valves and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

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.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory-

or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return and outdoor air.
2. Outdoor, concealed supply and return.
3. Outdoor, exposed supply and return.

B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.

5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Round and rectangular, supply-air and return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density, R-5.6.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

   1. Drainage piping located in crawl spaces.
   2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1/2 inch thick.

B. Refrigerant Suction and Hot-Gas Piping and Flexible Tubing:

   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1 inch thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

   1. None.

D. Piping, Exposed:

   1. PVC: 20 mils thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. Aluminum, Stucco Embossed with Z-Shaped Locking Seam: 0.016 inch thick.

END OF SECTION

SECTION 230800
COMMISSIONING OF HVAC

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 commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. 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 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.5 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

1.7 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 Testing AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.

4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

B. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

C. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

D. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

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 DESCRIPTION

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.

B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet.
The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.

C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified in 23 09 93 – “Sequence of Operations for HVAC Controls” shall be BACnet objects.

1.3 APPROVED CONTROL SYSTEM MANUFACTURERS

A. The following are approved control system suppliers, manufacturers, and product lines:

Supplier	Manufacturer	Product Line
ACCS	Automated Logic Corporation	WebCTRL
Pacific West Controls, Inc.	Automated Logic Corporation	WebCTRL
American Building Automation	Automated Logic Corporation	WebCTRL
Sunbelt Controls	Automated Logic Corporation	WebCTRL

The above list does not indicate order of preference. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.

1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
2. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.4 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications
   1. Installer shall have an established working relationship with Control System Manufacturer.
   2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.5 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to the receipt of bids of the following codes:
   1. National Electric Code (NEC)
   2. California Building Code (CBC)
   3. California Mechanical Code (CMC)
   4. California Electrical Code (CEC)
   5. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems

1.6 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
   1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
   2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec.and shall automatically refresh every 15 sec.
   3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
   4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
   5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 sec.
   6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
   7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
   8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
   9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
   10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table-1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5ºC (±1ºF)
Ducted Air	±0.5ºC (±1ºF)
Outside Air	±1.0ºC (±2ºF)
Dew Point	±1.5ºC (±3ºF)
Water Temperature	±0.5ºC (±1ºF)
Delta-T	±0.15º (±0.25ºF)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO2)	±50 ppm

Note 1: Accuracy applies to 10%–100% of scale
Note 2: For both absolute and differential pressure
Note 3: Not including utility-supplied meters

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0–1.5 kPa (0–6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0ºC (±2.0ºF)	
Duct Temperature	±1.5ºC (±3ºF)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1–150 psi) 0–12.5 kPa (0–50 in. w.g.) differential

1.7 SUBMITTALS

A. Product Data and Shop Drawings: Meet requirements of Section 01 30 00 on Shop Drawings, Product Data, and Samples. In addition, the contractor shall provide shop drawings or other submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and three 11” x 17” prints of each drawing. When manufacturer’s cutsheets apply to a product series rather than a specific

product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. DDC System Hardware
    a. A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
    b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
        i. Direct digital controllers (controller panels)
        ii. Transducers and transmitters
        iii. Sensors (including accuracy data)
        iv. Actuators
        v. Valves
        vi. Relays and switches
        vii. Control panels
        viii. Power supplies
        ix. Batteries
        x. Operator interface equipment
        xi. Wiring
    c. Wiring diagrams and layouts for each control panel. Show termination numbers.
    d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.
2. Central System Hardware and Software
    a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and relevant technical.
    b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:
        i. Central Processing Unit (CPU) or web server
        ii. Monitors
        iii. Keyboards
        iv. Power supplies
        v. Battery backups
        vi. Interface equipment between CPU or server and control panels
        vii. Operating System software
        viii. Operator interface software
        ix. Color graphic software
        x. Third-party software
    c. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show interface wiring to control system.
    d. Network riser diagrams of wiring between central control unit and control panels.
3. Controlled Systems

a. Riser diagrams showing control network layout, communication protocol, and wire types.
b. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
c. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
d. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
e. A mounting, wiring, and routing plan-view drawing. The design shall take into account HVAC, electrical, and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
f. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
g. A point list for each control system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.

4. Quantities of items submitted shall be reviewed but are the responsibility of the Contractor.
5. Description of process, report formats, and checklists to be used in Section 23 09 23 Article 3.17 (Control System Demonstration and Acceptance).
6. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

B. Schedules
1. Within one month of contract award, provide a schedule of the work indicating the following:
a. Intended sequence of work items
b. Start date of each work item
c. Duration of each work item
d. Planned delivery dates for ordered material and equipment and expected lead times
e. Milestones indicating possible restraints on work by other trades or situations
2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents. Upon completion of installation, submit three copies of record (as-built) documents of the documents shall be submitted for approval prior to final completion and shall include:
1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2006 (or newer) compatible files on magnetic or optical media (file format: .DWG, .DXF, .VSD, or comparable) and as 11" x 17" prints.
2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 23 09 23 Article 3.17 (Control System Demonstration and Acceptance).
3. Operation and Maintenance (O&M) Manual.
4. As-built versions of submittal product data.
5. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.

6. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
7. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
8. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
9. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
10. Graphic files, programs, and database on magnetic or optical media.
11. List of recommended spare parts with part numbers and suppliers.
12. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
13. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
14. Licenses, guarantees, and warranty documents for equipment and systems.
15. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.8 WARRANTY

A. Warrant work as follows:
1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional

enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.9 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
   1. Graphics
   2. Record drawings
   3. Database
   4. Application programming code
   5. Documentation

1.10 DEFINITIONS

Term	Definition
BACnet Interoperability Building Blocks (BIBB)	A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.
BACnet/BACnet Standard	BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
Control Systems Server	A computer(s) that maintain(s) the systems configuration and programming database.
Controller	Intelligent stand-alone control device. Controller is a generic reference to building controllers, custom application controllers, and application specific controllers.
Direct Digital Control	Microprocessor-based control including Analog/Digital conversion and program logic.
Gateway	Bi-directional protocol translator connecting control systems that use different communication protocols.
Local Area Network	Computer or control system communications network limited to local building or campus.
Master-Slave/Token Passing	Data link protocol as defined by the BACnet standard.
Point-to-Point	Serial communication as defined in the BACnet standard.
Primary Controlling LAN	High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
Protocol Implementation Conformance Statement	A written document that identifies the particular options specified by BACnet that are implemented in a device.
Router	A device that connects two or more networks at the network layer.
Wiring	Raceway, fittings, wire, boxes and related items.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
B. Install new wiring and network devices as required to provide a complete and workable control network.
C. Use existing Ethernet backbone for network segments marked "existing" on project drawings.
D. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
E. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
    1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
    2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 23 09 93. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
F. Workstations, Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.
G. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.
H. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization(WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.
    1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.
    2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
    3. For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.

4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

2.3 OPERATOR INTERFACE

A. The Operator Workstation or server shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L.

B. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information.

C. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

D. Hardware. Each workstation or web server shall consist of the following:

1. Computer. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The following hardware requirements also apply:
    a. The hard disk shall have sufficient memory to store:
        i. All required operator workstation software.
        ii. A DDC database at least twice the size of the delivered system database.
        iii. One year of trend data based on the points specified to be trended at their specified trend intervals.
    b. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.
    c. Minimum hardware configuration shall include the following:
        i. Dual or Quad Core Processor
        ii. 6 GB RAM
        iii. 500 GB hard disk providing data at 3.0 Gb/sec
        iv. 16x DVD-RW drive
        v. Serial, parallel, and network communication ports and cables as required for proper DDC system operation

E. System Software.

1. Operating System. Web server or workstation shall have an industry-standard professional-grade operating system. Operating system shall meet or exceed the DDC System manufacturers minimum requirements for their software. Typically acceptable systems include Microsoft Windows7,Microsoft Vista, Microsoft Windows XP Pro, Windows Server 2003 or 2008, Red Hat Enterprise Linux, or Ubuntu Desktop 10.04.
2. System Graphics. The operator interface software shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
    a. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of

equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

b. Animation. Graphics shall be able to animate by displaying different image files for changed object status.

c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Adobe Flash).

3. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in the same formats as are used for system graphics.

4. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

F. System Applications. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Manual Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection. Operators shall be able to configure the system.

4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

5. Security. Each operator shall be required to log on to the system with user name and password in order to view, edit, add, or delete data.

a. Operator Access. The user name and password combination shall define accessible viewing, editing, adding, and deleting privileges for that operator. Users with system administrator rights shall be able to create new users and edit the privileges of all existing users. System Administrators shall also be able to vary and deny each operator's privileges based on the geographic location, such as the ability to edit operating parameters in Building A, to view but not edit parameters in Building B, and to not even see equipment in Building C.

b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. This auto logoff time shall be user adjustable.
c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

6. System Diagnostics. The system shall automatically monitor the operation of all building management panels and controllers. The failure of any device shall be annunciated to the operator.
7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 93 (Sequences of Operation). Alarms shall be BACnet alarm objects and shall use BACnet alarm services.
8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying on acronyms.
9. Alarm Reactions. Operator shall be able to configure (by object) what, if any actions are to be taken during an alarm. As a minimum, the workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.
10. Alarm and Event log. Operators shall be able to view all system alarms and changes of state from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and delete alarms, and archive closed alarms to the workstation or web server hard disk.
11. Trend Logs. The operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Section 23 09 93 (Sequences of Operation). Trends shall be BACnet trend objects.
12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object or property in the system. The status shall be available by menu, on graphics, or through custom programs.
13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
14. Standard Reports. Furnish the following standard system reports:
    a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
    b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
    c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:
        i. Alarm History.
        ii. Trend Data. Operator shall be able to select trends to be logged.
        iii. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm

acknowledgment and deletion. System shall date and time stamp logged activity.

15. Energy Reports. System shall include an easily configured energy reporting tool that provides the capabilities described in this section.
    a. The energy reporting tool shall be accessible through the same user interface (Web browser or operator workstation software) as is used to manage the BAS.
    b. The energy reporting tool shall be preconfigured by the Contractor to gather and store energy demand and consumption data from each energy source that provides metered data to the BAS. Meter data shall be stored at 5 minute intervals unless otherwise specified in the Sequence of Operation provided in section 23 09 93. This data shall be maintained in an industry standard SQL database for a period of not less than five years.
    c. The energy reporting tool shall allow the operator to select an energy source and a time period of interest (day, week, month, year, or date range) and shall provide options to view the data in a table, line graph, bar graph, or pie chart. The tool shall also allow the operator to select two or more data sources and display a comparison of the energy used over this period in any of the listed graph formats, or to total the energy used by the selected sources and display that data in the supported formats.
    d. The energy reporting tool shall allow the operator to select and energy source and two time periods of interest (day, week, month, year, or date range) and display a graph that compares the energy use over the two time periods in any of the graph formats listed in the previous paragraph. The tool shall also allow the operator to select multiple energy sources and display a graph that compares the total energy used by these sources over the two time periods.
    e. The energy reporting tool shall allow the operator to easily generate the previously described graphs "on the fly," and shall provide an option to store the report format so the operator can select that format to regenerate the graph at a future date. The tool shall also allow the user to schedule these reports to run on a recurring basis using relative time periods, such as automatically generating a consumption report on the first Monday of each month showing consumption over the previous month. Automatically generated reports shall be archived on the server in a common industry format such as Adobe PDF or Microsoft Excel with copies e-mailed to a user editable list of recipients.
    f. The energy reporting tool shall be capable of collecting and displaying data from the following types of meters:
        i. Electricity
        ii. Gas
        iii. Oil
        iv. Steam
        v. Chilled Water
        vi. Potable Water
        vii. Heating and cooling degree days. (May be calculated from sensor data rather than metered.)
    g. The user shall have the option of using Kw (Kwh) or Btu/hr (Btu) as the units for demand and consumption reports. Multiples of these units (MWH, kBtu, etc.) shall be used as appropriate. All selected sources shall be

automatically converted to the selected units. The user shall similarly have the option of entering facility area and occupancy hours and creating reports that are normalized on an area basis, an annual use basis, or an occupied hour basis.

h. The user shall have the option of entering benchmark data for an individual facility or a group of facilities.

i. The user shall have the option of displaying any or all of the following data on any chart, line, or bar graph generated by the energy reporting tool:

i. Low/High/Average value of the metered value being displayed.

ii. Heating and/or Cooling Degree Days for the time period(s) being displayed.

16. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

G. Workstation Application Editors. Each PC or browser workstation shall support editing of all system applications. The applications shall be downloaded and executed at one or more of the controller panels.

1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.

2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and schedule type. Exception schedules and holidays shall be shown clearly on the calendar. The start and stop times for each object shall be adjustable from this interface.

3. Custom Application Programming. Provide the tools to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.

b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

g. Variables. Operator shall be able to use variable values in program conditional statements and mathematical functions.

i. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

ii. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

H. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator’s Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

2.4 CONTROLLER SOFTWARE

A. Furnish the following applications for building and energy management. All software application shall reside and operate in the system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. System Security. See Paragraph 2.3.E.5 (Security) and Paragraph 2.3.E.14.c.iii (Operator Activity).

C. Scheduling. Provide the capability to execute control functions according to a user created or edited schedule. Each schedule shall provide the following schedule options as a minimum:

1. Weekly Schedule. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).
2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule has executed, the system shall discard and replace the exception schedule with the standard schedule for that day of the week.
3. Holiday Schedules. Provide the capability for the operator to define up to 24 special or holiday schedules. These schedules will be repeated each year. The operator shall be able to define the length of each holiday period.

D. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

E. Binary Alarms. Each binary object shall have the capability to be configured to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.

F. Analog Alarms. Each analog object shall have both high and low alarm limits. The operator shall be able to enable or disable these alarms.

G. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display on graphics.

H. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

I. Demand Limiting.
   1. The demand-limiting program shall monitor building power consumption from a building power meter (provided by others) which generates pulse signals or a BACnet communications interface. An acceptable alternative is for the system to monitor a watt transducer or current transformer attached to the building feeder lines.
   2. When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand as specified in Section 23 09 93 (Sequences of Operation). When demand drops below adjustable levels, system shall restore loads as specified.

J. Maintenance Management. The system shall be capable of generating maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in 23 09 93 (Sequences of Operation).

K. Sequencing. Application software shall sequence chillers, boilers, and pumps as specified in Section 23 09 93 (Sequences of Operation).

L. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs. The calculation interval, PID gains, and other tuning parameters shall be adjustable by a user with the correct security level.

M. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

N. Energy Calculations.
   1. The system shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
   2. The system shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

O. Anti-Short Cycling. All binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

P. On and Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and a setpoint. The algorithm shall be direct-acting or reverse-acting.

Q. Runtime Totalization. Provide software to totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified in Section 23 09 93 (Sequence of Operations).

2.5 CONTROLLERS

A. General. Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified in Section 23 09 23 Article 1.9 (System Performance). Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

B. BACnet.

1. Building Controllers (BCs). Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L, and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.
4. Smart Sensors (SSs). Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.
5. BACnet Communication.
    a. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.
    b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
    c. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
    d. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
    e. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
    f. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

C. Communication
1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation. Each piece of equipment specified in Section 23 09 93 shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.

D. Environment. Controller hardware shall be suitable for anticipated ambient conditions.
1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).

2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

E. Keypad. Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.

F. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

G. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

H. Memory.

1. Controller memory shall support operating system, database, and programming requirements.
2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

I. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

J. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground shall cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no controller damage.

C. Binary Inputs. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall also accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0–10 Vdc), current (4–20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall provide for ON/OFF operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on Building Controllers shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0–10 Vdc or a 4–20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
    a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
    b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
    a. Dielectric strength of 1000 V minimum
    b. Response time of 10 nanoseconds or less
    c. Transverse mode noise attenuation of 65 dB or greater
    d. Common mode noise attenuation of 150 dB or greater at 40–100 Hz

2.8 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers, unless otherwise specified elsewhere, shall be as follow.

1. Type. Control dampers shall be the parallel or opposed-blade type as specified below or as scheduled on drawings.
    a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
    b. Other modulating dampers shall be opposed-blade.
    c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.
2. Frame. Damper frames shall be 2.38 mm (13 gauge) galvanized steel channel or 3.175 mm (⅛ in.) extruded aluminum with reinforced corner bracing.

3. Blades. Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16 gauge).
4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s·m^2(10 cfm per ft^2) at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).
6. Sections. Individual damper sections shall not exceed 125 cm × 150 cm (48 in. × 60 in.). Each section shall have at least one damper actuator.
7. Modulating dampers shall provide a linear flow characteristic where possible.
8. Linkages. Dampers shall have exposed linkages.

B. Electric Damper and Valve Actuators.
1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
3. Signal and Range. Proportional actuators shall accept a 0–10 Vdc or a 0–20 mA control signal and shall have a 2–10 Vdc or 4–20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank.

C. Temperature Sensors.
1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m^2(10 ft^2) of duct cross-section.
3. Space Sensors. Space sensors shall have override switch and communication port only.
4. Differential Sensors. Provide matched sensors for differential temperature measurement.

D. Humidity Sensors.
1. Duct and room sensors shall have a sensing range of 20%–80%.
2. Duct sensors shall have a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20%–95% RH and shall be suitable for ambient conditions of -40°C–75°C (-40°F–170°F).
4. Humidity sensors shall not drift more than 1% of full scale annually.

E. Relays.
1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

F. Override Timers.
   1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0–6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.

G. Current Transmitters.
   1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4–20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
   2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
   3. Unit shall be split-core type for clamp-on installation on existing wiring.

H. Current Transformers.
   1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
   2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
   3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

I. Voltage Transmitters.
   1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4–20 mA output with zero and span adjustment.
   2. Adjustable full-scale unit ranges shall be 100–130 Vac, 200–250 Vac, 250–330 Vac, and 400–600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
   3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

J. Voltage Transformers.
   1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
   2. Transformers shall be suitable for ambient temperatures of 4°C–55°C (40°F–130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
   3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

K. Power Monitors.
   1. Selectable rate pulse output for kWh reading, 4–20 mA output for kW reading, N.O. alarm contact, and ability to operate with 5.0 amp current inputs or 0–0.33 volt inputs.
   2. 1.0% full-scale true RMS power accuracy, +0.5 Hz, voltage input range 120–600 V, and auto range select.
   3. Under voltage/phase monitor circuitry.
   4. NEMA 1 enclosure.
   5. Current transformers having a 0.5% FS accuracy, 600 VAC isolation voltage with 0–0.33 V output. If 0–5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.

L. Current Switches.
   1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

M. Pressure Transducers.
   1. Transducers shall have linear output signal and field-adjustable zero and span.

2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.

N. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

O. Pressure-Electric (PE) Switches.
1. Shall be metal or neoprene diaphragm actuated, operating pressure rated for 0–175 kPa (0–25 psig), with calibrated scale minimum setpoint range of 14–125 kPa (2–18 psig) minimum, UL listed.
2. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application Electrically rated for pilot duty service (125 VA minimum) and/or for motor control.
3. Switches shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.
4. Each pneumatic signal line to PE switches shall have permanent indicating gauge.

P. Occupancy Sensors. Occupancy sensors shall utilize Passive Infrared (PIR) and/or Microphonic Passive technology to detect the presence of people within a room. Sensors shall be mounted as indicated on the approved drawings. The sensor output shall be accessible by any lighting and/or HVAC controller in the system. Occupancy sensors shall be capable of being powered from the lighting or HVAC control panel, as shown on the drawings. Occupancy sensor delay shall be software adjustable through the user interface and shall not require manual adjustment at the sensor.

Q. Local Control Panels.
1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
2. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

2.10 FIBER OPTIC CABLE SYSTEM

A. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.

B. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

PART 3 – EXECUTION

3.1 EXAMINATION

A. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

B. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and at the expense of—this contractor.

3.2 PROTECTION

A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site
   1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
   2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Submittals. See Section 23 09 23 Article 1.10 (Submittals).

C. Test and Balance.
   1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
   2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
   3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
   4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

D. Life Safety.
   1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in Section 23 09 93 (Sequences of Operation).

2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in Section 23 09 93 (Sequences of Operation).
3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.

E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
1. All communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).
2. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the sequences of operation described in Section 23 09 93.
3. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
4. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).
D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.8 (Codes and Standards).
B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.
C. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.

3.6 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification, Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.
C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.
D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.
E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 3 m (10ft).
F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
G. Do not install wiring in raceway containing tubing.
H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.
I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
O. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.
P. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
Q. Use color-coded conductors throughout with conductors of different colors.
R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
S. Conceal all raceways except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues).
T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
U. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.
V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.
W. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal raceway less than ½ in.

electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.7 COMMUNICATION WIRING

A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.
B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling
C. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.
D. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
E. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to manufacturer’s instructions.
G. All runs of communication wiring shall be unspliced length when that length is commercially available.
H. All communication wiring shall be labeled to indicate origination and destination data.
I. All communication wiring shall be labeled to indicate origination and destination data.
J. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
K. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:
    1. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot.)
    2. The maximum length of an MS/TP segment is 1200 meters (4000 ft) with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.
    3. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
    4. An MS/TP EIA-485 network shall have no T connections.

3.8 FIBER OPTIC CABLE

A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

3.9 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.
B. Mount sensors rigidly and adequately for environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing.
D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.
E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m^2(1 ft^2) of coil area.
G. Do not install temperature sensors within the vapor plume of a humidifier. If installing a sensor downstream of a humidifier, install it at least 3 m (10 ft) downstream.
H. All pipe-mounted temperature sensors shall be installed in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.
I. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
J. Differential Air Static Pressure.
    1. Supply Duct Static Pressure. Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
    2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.
    3. Building Static Pressure. Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
    4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
    5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
    6. All air differential pressure sensors shall have gauge tees mounted adjacent to the taps.
K. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.10 ACTUATORS

A. General. Mount and link control damper actuators according to manufacturer's instructions.
    1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
    2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
    3. Provide all mounting hardware and linkages for actuator installation.
B. Electric/Electronic

1. Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer's recommendations.

3.11 WARNING LABELS

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the control system.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.

C A U T I O N
This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to"Off"position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
   1. Labels shall use white lettering (12-point type or larger) on a red background.
   2. Warning labels shall read as follows.

C A U T I O N
This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.12 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.
B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.
C. Permanently label or code each point of field terminal strips to show the instrument or item served.
D. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.
F. Identify room sensors related to terminal boxes or valves with nameplates.
G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
H. Identifiers shall match record documents.

3.13 CONTROLLERS

A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in Section 23 09 93 (Sequences of Operation).

3.14 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging.
B. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. See Section 23 09 93 (Sequences of Operation). If character limitations or space restrictions make it advisable to shorten the name, the abbreviations given in Appendix B to Section 23 09 93 may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.
C. Software Programming.
    1. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Embed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
        a. Text-based:
            i. Must provide actions for all possible situations
            ii. Must be modular and structured
            iii. Must be commented
        b. Graphic-based:
            i. Must provide actions for all possible situations
            ii. Must be documented
        c. Parameter-based:
            i. Must provide actions for all possible situations
            ii. Must be documented.
D. Operator Interface.
    1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List in Section 23 09 93.
    2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

3.15 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner’s representative is notified of the system demonstration.

1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.
4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
6. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.
7. Alarms and Interlocks:
    a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
    b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
    c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

3.16 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration.
1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
6. Demonstrate compliance with Part 1, "System Performance."
7. Demonstrate compliance with sequences of operation through all modes of operation.
8. Demonstrate complete operation of operator interface.
9. Additionally, the following items shall be demonstrated:
    a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
    b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.
    c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
    d. Interface to the building fire alarm system.
    e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance.
1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals."

3.17 CLEANING

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.18 TRAINING

A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Training shall enable students to accomplish the following objectives.

1. Day-to-day Operators:
    a. Proficiently operate the system
    b. Understand control system architecture and configuration
    c. Understand DDC system components
    d. Understand system operation, including DDC system control and optimizing routines (algorithms)
    e. Operate the workstation and peripherals
    f. Log on and off the system
    g. Access graphics, point reports, and logs
    h. Adjust and change system set points, time schedules, and holiday schedules
    i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
    j. Understand system drawings and Operation and Maintenance manual
    k. Understand the job layout and location of control components
    l. Access data from DDC controllers and ASCs
    m. Operate portable operator's terminals
2. Advanced Operators:
    a. Make and change graphics on the workstation
    b. Create, delete, and modify alarms, including annunciation and routing of these
    c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals
    d. Create, delete, and modify reports
    e. Add, remove, and modify system's physical points
    f. Create, modify, and delete programming
    g. Add panels when required
    h. Add operator interface stations
    i. Create, delete, and modify system displays, both graphical and others
    j. Perform DDC system field checkout procedures
    k. Perform DDC controller unit operation and maintenance procedures
    l. Perform workstation and peripheral operation and maintenance procedures
    m. Perform DDC system diagnostic procedures
    n. Configure hardware including PC boards, switches, communication, and I/O points
    o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
    p. Adjust, calibrate, and replace system components
3. System Managers/Administrators:
    a. Maintain software and prepare backups
    b. Interface with job-specific, third-party operator software
    c. Add new users and understand password security procedures

C. Organize the training into sessions or modules for the three levels of operators listed above. (Day-to-Day Operators, Advanced Operators, System Managers and Administrators). Students will receive one or more of the training packages, depending on knowledge level required.
D. Provide course outline and materials according to the "Submittals" article in Part 1 of this specification. Provide one copy of training material per student.
E. The instructor(s) shall be factory-trained and experienced in presenting this material.
F. Classroom training shall be done using a network of working controllers representative of installed hardware.

3.19 SEQUENCES OF OPERATION

See Drawings for Sequences of Operations

3.20 CONTROL DAMPER INSTALLATION

A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure ¼ in. larger than damper dimensions and shall be square, straight, and level.
C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8 in.) of each other.
D. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
E. Install extended shaft or jackshaft according to manufacturer’s instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)
F. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.
G. Provide a visible and accessible indication of damper position on the drive shaft end.
H. Support ductwork in area of damper when required to prevent sagging due to damper weight.
I. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

3.21 DUCT SMOKE DETECTION

A. Submit data for coordination of duct smoke detector interface to HVAC systems as required in Part 1, "Submittals."
B. This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

3.22 CONTROLS COMMUNICATION PROTOCOL

A. General. The electronic controls packaged with this equipment shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as

defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.

B. Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions if the network connection is lost.
C. I/O Capacity. The controller shall contain sufficient I/ O capacity to control the target system.
D. The Controller shall have a physical connection for a laptop computer or a portable operator's tool.
E. Environment. The hardware shall be suitable for the anticipated ambient conditions.
    1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 40°C to 60°C (40°F to 140°F).
    2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.
G. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 30 days.
H. Power. Controller shall be able to operate at 90% to 110% of nominal voltage rating.
I. Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

3.23 START-UP AND CHECKOUT PROCEDURES

A. Start up, check out, and test all hardware and software and verify communication between all components.
    1. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
    2. Verify that all analog and binary input/output points read properly.
    3. Verify alarms and interlocks.
    4. Verify operation of the integrated system.

APPENDIX A: Glossary of Terms

Terms used within the Specification Text:

- Advanced Application Controller (AAC):

A fully programmable control module. This control module may be capable of some of the advanced features found in Building Controllers (storing trends, initiating read and write requests, etc.) but it does not serve as a master controller. Advanced Application Controllers may reside on either the Ethernet/IP backbone or on a subnet.

- Application Specific Controller (ASC):

A pre-programmed control module which is intended for use in a specific application. ASCs may be

configurable, in that the user can choose between various pre-programmed options, but it does not support full custom programming. ASCs are often used on terminal equipment such as VAV boxes or fan coil units. In many vendors' architectures ASCs do not store trends or schedules but instead rely upon a Building Controller to provide those functions.

- BACnet/IP:

An approved BACnet network type which uses an Ethernet carrier and IP addressing.

- BACnet MS/TP:

An approved BACnet network type which uses a Master-Slave Token Passing configuration. MS/TP networks are unique to BACnet and utilize EIA485 twisted pair topology running at 9600 to 76,800 bps.

- BACnet over ARCNET:

An approved BACnet network type which uses an ARCNET (attached resource computer network) carrier. ARCNET is an industry standard that can utilize several speeds and wiring standards. The most common configuration used by BACnet controllers is an EIA485 twisted pair topology running at 156,000 bps.

- Building Controller (BC):

A fully programmable control module which is capable of storing trends and schedules, serving as a router to devices on a subnet, and initiating read and write requests to other controllers. Typically this controller is located on the Ethernet/IP backbone of the BAS. In many vendors' architectures a Building Controller will serve as a master controller, storing schedules and trends for controllers on a subnet underneath the Building Controller.

- Direct Digital Control (DDC):

A control system in which a digital computer or microprocessor is directly connected to the valves, dampers, and other actuators which control the system, as opposed to indirectly controlling a system by resetting setpoints on an analog pneumatic or electronic controller.

- PICS - Protocol Implementation Conformance Statement:

A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device.

- Smart Actuator (SA):

An actuator which is controlled by a network connection rather than a binary or analog signal. (0-10v, 4-20mA, relay, etc.)

- Smart Sensor (SS):

A sensor which provides information to the BAS via network connection rather than a binary or analog signal. (0-10000 ohm, 4-20mA, dry contact, etc.)

- Web services:

Web services are a standard method of exchanging data between computer systems using the XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services can be used at any level within a Building Automation System (BAS), but most commonly they are used to transfer data between BAS using different protocols or between a BAS and a non-BAS system such as a tenant billing system or a utility management system.

Terms used within the Sequences of Operation:

- adj.

Adjustable by the end user, through the supplied user interface.

- AI, AO, etc. (Column Headings on Points List)

AI = Analog Input. A physical input to the control module.
AO = Analog Output. A physical output from the control module.
AV = Analog Value. An intermediate (software) point that may be editable or read-only. Editable AVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only AVs are typically used to display the status of a control operation.
BI = Binary Input. A physical input to the control module.
BO = Binary Output. A physical output from the control module.
BV = Binary Value. An intermediate (software) point that may be editable or read-only. Editable BVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only BVs are typically used to display the status of a control operation.
Loop = A control loop. Most commonly a PID control loop. Typically a control loop will include a setpoint, an input which is compared to the setpoint, and an output which controls some action based upon the difference between the input and the setpoint. A PID control loop will also include gains for the proportional, integral, and derivative response as well as an interval which controls how frequently the control loop updates its output. These gains may be adjustable by the end user for control loop "tuning," but in self-tuning control loops or loops which have been optimized for a specific application the gains may not be adjustable.
Sched = Schedule. The control algorithm for this equipment shall include a user editable schedule.
Trend. The control system shall be configured to collect and display a trend log of this object. The trending interval shall be no less than one sample every 5 minutes. (Change of Value trending, where a sample is taken every time the value changes by more than a user-defined minimum, is an acceptable alternative.)
Alarm. The control system shall be configured to generate an alarm when this object exceeds user definable limits, as described in the Sequence of Controls.

Note:If the specifications require use of the BACnet protocol, all of the above shall be provided as BACnet objects.

- KW Demand Limiting: *

An energy management strategy that reduces energy consumption when a system's electric power meter exceeds an operator-defined threshold.

When power consumption exceeds defined levels, the system automatically adjust setpoints, de-energizes low priority equipment, and takes other pre-programmed actions to avoid peak demand charges.

As the demand drops, the system restores loads in a predetermined manner.

- Occupant Override Switch, or Timed Local Override:

A control option that allows building occupants to override the programmed HVAC schedule for a limited period of time.

When the override time expires, the zone returns to its unoccupied state.

- Occupant Setpoint Adjustment:

A control option that allows building occupants to adjust - within limits set by the HVAC control system - the heating and cooling setpoints of selected zones. Typically the user interface for this function is built into the zone sensor.

- Optimal Start-Up: *

A control strategy that automatically starts an HVAC system at the latest possible time yet ensures comfort conditions by the time the building becomes occupied.

In a typical implementation, a controller measures the temperature of the zone and the outside air. Then, using design heating or cooling capacity at the design outside air temperature, the system computes how long a unit must run at maximum capacity to bring the zone temperature to its occupied setpoint.

The optimal start algorithm often includes a self-learning feature to adjust for variations from design capacity.

A distributed system must use Run on Request with Optimal Start. (See below.)

- Requested, or Run on Request: *

A control strategy that optimizes the runtime of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service. Source equipment runs only when needed, not on a fixed schedule.

The source equipment runs when one or more receiving units request its services. An operator determines how many requests are required to start the source equipment.

For example, if all the zones in a building are unoccupied and the zone terminal units do not need heating or cooling, the AHU will shut down. However, if a zone becomes occupied or needs cooling, the terminal unit will send a run request to the AHU to initiate the start-up sequence. If this AHU depends on a central chiller, it can send a run request to the chiller.

The run on request algorithm also allows an operator to schedule occupancy for individual zones based on the needs of the occupants without having to adjust the schedules of related AHUs and chillers.

- Trim and Respond, or Setpoint Optimization: *

A control strategy that optimizes the setpoint of a source piece of equipment that supplies one or more

receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service.

The source unit communicates with receiving units to determine heating, cooling, and other requirements, and then adjusts its setpoint.

For example, if all zones are comfortable and do not request cooling, the AHU will gradually increase (trim) its supply air setpoint. When a zone requests cooling, the AHU responds by dropping its setpoint. The more zones that request cooling, the more it drops the setpoint. The AHU repeats this process throughout the day to keep zones cool, but with a supply air setpoint that is no cooler than necessary.

Contracting Terms:

- Furnished or Provided:

The act of supplying a device or piece of equipment as required meeting the scope of work specified and making that device or equipment operational. All costs required to furnish the specified device or equipment and make it operational are borne by the division specified to be responsible for providing the device or equipment.

- Install or Installed:

The physical act of mounting, piping or wiring a device or piece of equipment in accordance with the manufacturer's instructions and the scope of work as specified. All costs required to complete the installation are borne by the division specified to include labor and any ancillary materials.

- Interface:

The physical device required to provide integration capabilities from an equipment vendor's product to the control system. The equipment vendor most normally furnishes the interface device. An example of an interface is the chilled water temperature reset interface card provided by the chiller manufacturer in order to allow the control system to integrate the chilled water temperature reset function into the control system.

- Integrate:

The physical connections from a control system to all specified equipment through an interface as required to allow the specified control and monitoring functions of the equipment to be performed via the control system.

APPENDIX B: Abbreviations

The following abbreviations may be used in graphics, schematics, point names, and other UI applications where space is at a premium.

AC - Air Conditioning
ACU - Air Conditioning Unit
AHU - Air Handling Unit
AI - Analog Input
AO - Analog Output
AUTO - Automatic
AUX - Auxiliary
BI -Binary Input
BO -Binary Output
C -Common
CHW - Chilled Water
CHWP - Chilled Water Pump
CHWR - Chilled Water Return
CHWS - Chilled Water Supply
COND - Condenser
CW - Condenser Water
CWP - Condenser Water Pump
CWR - Condenser Water Return
CWS - Condenser Water Supply
DA - Discharge Air
EA - Exhaust Air
EF - Exhaust Fan
EVAP - Evaporators
FCU - Fan Coil Unit
HOA - Hand / Off / Auto
HP - Heat Pump
HRU - Heat Recovery Unit
HTEX - Heat Exchanger
HW - Hot Water
HWP - Hot Water Pump
HWR - Hot Water Return
HWS - Hot Water Supply
MAX - Maximum
MIN - Minimum
MISC - Miscellaneous
NC - Normally Closed
NO - Normally Open
OA - Outdoor Air
PIU - Powered Induction Unit
RA - Return Air
RF - Return Fan
RH - Relative Humidity
RTU - Roof-top Unit
SA - Supply Air
SF - Supply Fan

SP - Static Pressure
TEMP - Temperature
UH - Unit Heater
UV - Unit Ventilator
VAV - Variable Air Volume
VVTU - Variable Volume Terminal Unit
W/ - with
W/O - without
WSHP - Water Source Heat Pump

END OF SECTION

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SECTION 231710
VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

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

1.2 PRINCIPAL WORK IN THIS SECTION

A. Variable frequency drives.

B. Materials, equipment, fabrication, installation and tests, in conformity with applicable codes and authorities having jurisdiction, for variable frequency drives (VFD's).

1.3 QUALITY ASSURANCE

A. Refer to General Provisions.

B. Manufacturer: Company specializing in manufacture of variable frequency drives and their accessories, with minimum ten years documented product development, testing, and manufacturing experience in the horsepower range required.

C. VFD's shall have a minimum MTBF (mean time between failure) rating of 28 years.

1.4 SUBMITTALS

A. Submit product data, drawings and diagrams for the following items per the provisions of Division 1 and this Division's General provisions:

1. Product data: Manufacturer's catalog cuts, ratings and installation instructions.

2. Diagrams: wiring diagrams including all external connections.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Variable Frequency Drives:

1. Square D.

2. ABB

3. Danfoss Graham.

2.2 VARIABLE FREQUENCY DRIVES

A. General:

1. Motors shall be provided with UL Listed variable frequency drive (VFD) control systems.

2. Motors shall be provided with a microprocessor based, pulse width modulated (PWM) variable frequency drive (VFD) control systems as specified or noted.

3. The adjustable frequency AC motor drive shall be designed to convert the 60 hertz input power to adjustable frequency output power. The output frequency and voltage of the drive shall be adjustable such that a constant volts/Hz ratio is determined from the design parameters of the driven motor.

4. Drive shall be capable of operating any standard squirrel cage induction motor with load rating within the capacity of the drive. At any time in the future, it shall be possible to substitute a new or rewound motor in the field without requiring modification of the drive.

5. For maintenance purposes, drive shall be capable of starting, stopping and running with stable operation with the motor completely disconnected (no load).

6. Input AC line reactor shall be provided by manufacturers of VFD.

B. Features:

1. Drive enclosure shall be a NEMA Type 1 or equivalent, wall or floor mounted, metal cabinet with hinged front access door(s), filtered ventilation system (if required), and controls that are mounted, wired and tested.

2. Fused, interlocked disconnect switch or input line circuit breaker, externally operated, interlocked with enclosure door. Short circuit interrupting rating of 200,000 amps.

3. Internal 115 VAC control power circuit with transformer and primary and secondary protective fuses.

4. One normally open and one normally closed contacts from run relay, wired to terminal for customer use. Contactors to enable control of drive from a central control system for start/stop and load shed operation through remote speed reset.

5. Controlled acceleration and deceleration, separately adjustable, shall be provided from 0.5 to 200 seconds with torque limit override acceleration protection and regeneration protection during deceleration.

6. Drive shall automatically adjust the volts/Hz ratio to the motor in proportion to its load without changing speed in order to conserve the maximum amount of energy.

7. Separately adjustable maximum and minimum frequency limits shall be provided.

8. Low frequency/low voltage start with linearly adjustable ramp up to pre-selected speed.

9. All components shall be accessible from the cabinet door for service. Drive must be designed for side-by-side, back-to-back and against-the-wall installation.

10. Digitally displayed AC ammeter and percent load meter, located on door.

11. Digitally displayed speed control and speed indicator, located on door.

12. Digitally displayed voltmeter, located on door.

13. Hand/off/auto switch with start/stop pushbuttons or switches.

    a. In the "hand" position, the speed is controlled by the door mounted speed control and the start/stop commands are controlled by the door mounted start/stop pushbuttons or switches.

    b. In the "off" position, the drive cannot be started.

    c. In the "auto" position, the speed is controlled by a remote electronic signal and the drive can receive only a remote start command (momentary contact closure). The stop command in the auto position can be either remote or from the door mounted stop pushbutton or switch (to ensure maximum safety).

    d. To facilitate equipment setup, the drive shall not undergo complete shutdown when moving the selector switch from the hand position to the auto position.

14. Drive fault alarm contact for remote indication.

15. Automatic reset of drive to receive start command after any normal shutdown, including power outages.

16. Remote electrical input signal for speed control(to be coordinated with control Contractor).

17. Critical speed rejection circuit.

18. Drive shall be constructed with integral protection against all normal transients and surges in the incoming power line, any grounding or disconnecting of the output power line, and any interruption or runaway of the incoming speed reference signal. Protection is defined as a normal shutdown or return to original speed with no component damage.

19. Drive shall protect itself against all phase-to-phase and phase-to-ground faults.

20. Drive shall protect itself against any removal of load.

21. Drive shall employ adjustable torque limit control to override the speed command and decrease the frequency while maintaining the correct volts/Hz ratio whenever the load level surpasses the drive design level.

22. Drive shall protect itself against single-phasing and power outages and shall be insensitive to input phase rotation.

23. Drive shall start into a spinning motor or shut down with no component damage.

24. Drive shall ride through any input power dip of three cycles or less.

25. Drive shall go through an orderly shutdown when the incoming voltage low limit is surpassed.

26. Instantaneous overcurrent trip (IOT) shall continuously monitor peak currents. It shall provide instantaneous shutdown without component failure when high limit setting is surpassed.

27. Torque limit shall be settable from 50 to 100 percent of full drive rating on variable torque loads. When torque limit engages, the output frequency is steadily reduced until the load reduces to the design capacity. At that point, the speed will stabilize. If the load reduces further, the drive shall re-accelerate to the preset speed.

28. Manual bypass shall be provided when indicated by the schedule. VFD and bypass components shall be mounted inside a common NEMA 1 enclosure, fully pre-wired and ready for installation as a single UL listed device. Bypass shall include the following:

    a. Input, output, and bypass contactors, to disconnect power to the VFD, when the motor is running in the bypass mode.

    b. 115 V.A.C. control transformer, with fused primary.

    c. Thermal overload relay, to protect the motor while operating in the bypass mode.

    d. Circuit breaker/disconnect switch, with a “through-the-door” handle mechanism.

    e. Control and safety circuit terminal strip.

    f. “Drive-Off-Bypass” selector switch.

    g. Pilot lights for “Power On” and “Fault”.

h. “Normal/Test” selector switch, to allow testing and adjustment of the VFD while the motor is running in the bypass mode.

29. UL listed, nonlinear isolation transformer to prevent noise and harmonic feedback to electrical system. Shall be mounted in NEMA 1 enclosure and be of dry type construction with Class H insulation. Transformer shall be provided by variable frequency drive manufacturer to match performance of variable frequency drive(s).

30. The VFD must meet the requirements for Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.

31. A digital diagnostic system which monitors its own control functions and displays faults and operating conditions.

32. Operating conditions:

    a. Line voltage variations: +10 percent, -5 percent.

    b. Line frequency variations: ±2 hertz.

    c. Overload capability of up to 130 percent of full drive rating for variable torque loads.

    d. Ambient temperature: 0°C to 40°C.

    e. Maximum altitude limit: 3,300 feet.

    f. Maximum humidity: 95 percent (non-condensing).

    g. Efficiency in excess of 95 percent at full load/full speed and in excess of 80 percent at half speed on a variable torque load (cubic load).

33. Serial communication.

34. VFD shall be capable of PID (Proportional, Integral, Derivative) logic, to provide closed-loop setpoint control capability, from a remote reference. In addition, an energy saving sleep function should be used in conjunction with the PID control. The SLEEP function reduces the unnecessary operation of equipment. When the SLEEP function senses a minimal deviation of a sensor (pressure, temperature), the system reacts by removing the run signal from the equipment. Upon receiving an ample sensor signal deviation, the equipment returns the run signal and resumes normal operation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Coordinate drive equipment with motors supplied under Motors and Motor Controllers.

C. Factory representative shall inspect final installation of all drives and connected wiring and make all final adjustments to meet specified performance.

3.2 TESTS

A. Manufacturer shall conduct factory tests to assure conformance to specification requirements.

B. All power components shall be run-tested under specified temperature and load conditions.

C. Complete records of test procedure and results shall be made available at no cost to Owner's representative.

3.3 TRAINING

A. Factory representative shall provide on-site training of operating personnel after the system is fully operational.

3.4 WARRANTY

A. Three-year warranty from date of shipment.

END OF SECTION

SECTION 233113
METAL DUCTS

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. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

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

B. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Penetrations of smoke barriers and fire-rated construction.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and

duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

2. Maximum Thermal Conductivity:
a. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. 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).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.
8. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

1. Cover and seal open ends of ducts with plastic wrap and duct tape.
2. Turn off ventilation system and protect duct interiors from dust infiltration during dust producing activities (e.g. demolition, drywall installation, finishing).

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.

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. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

C. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

3.9 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply and Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

1. Ducts Connected to Dust Collection Systems:

a. Pressure Class: Negative 10-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 1-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 1-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

F. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1.5 PCF, 1-1/2 inches thick.
2. Return Air Ducts: Fibrous glass, Type I, 1.5 PCF, 1-1/2 inches thick.
3. Exhaust Air Ducts: Fibrous glass, Type I, 1.5 PCF, 1-1/2 inches thick.
4. Supply Fan Plenums: Fibrous glass, Type II, 3.0 PCF, 2 inches thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 3.0 PCF, 2 inches thick.
6. Transfer Ducts: Fibrous glass, Type I, 1.5 PCF, 1-1/2 inches thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 13 Inches and Larger in Diameter: Spot welded seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

a. All shall be 45-degree lateral.

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Combination fire and smoke dampers.
6. Flange connectors.
7. Duct silencers.
8. Turning vanes.
9. Remote damper operators.
10. Duct-mounted access doors.
11. Flexible connectors.
12. Flexible ducts.
13. Duct accessory hardware.

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.

1.3 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 3 finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 4500 fpm.

D. Maximum System Pressure: 10-inch wg.

E. Frame: 0.052-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Vinyl foam.

I. Blade Axles:

1. Material: Galvanized steel or Stainless steel.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.

   a. Sleeve Thickness: 20-gage minimum.
   b. Sleeve Length: 6 inches minimum.

6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel or Aluminum.
8. Screen Type: Bird.
9. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.

4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.064-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades:

1. Multiple, 0.025-inch-thick, roll-formed aluminum.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

G. Blade Seals: Vinyl.

H. Blade Axles: Galvanized steel.

I. Tie Bars and Brackets:

1. Material: Galvanized steel.
2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic or Stainless steel.

L. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow LLC.
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Pottorff; a division of PCI Industries, Inc.
h. Ruskin Company.
i. Trox USA Inc.
j. Vent Products Company, Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

   a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel or Stainless steel.
7. Bearings:

   a. Molded synthetic or Stainless-steel sleeve.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. Lloyd Industries, Inc.
8. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
9. McGill AirFlow LLC.
10. METALAIRE, Inc.
11. Metal Form Manufacturing, Inc.
12. Nailor Industries Inc.
13. NCA Manufacturing, Inc.
14. Ruskin Company.
15. Vent Products Company, Inc.
16. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.
2. **Galvanized** or **Stainless**-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8 inches.
2. Parallel-blade design.
3. Galvanized or Stainless steel.
4. 0.064 inch thick.
5. Blade Edging: Closed-cell neoprene edging.

E. Blade Axles: 1/2-inch-diameter; galvanized steel or stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Molded synthetic or Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

G. Smoke Detector: Refer to Division 28.

H. Blades: True airfoil shaped, single piece 14 ga. or double skin 16 and 20 ga. galvanized steel. Opposed action, maximum 6 inches width. Self-lubricating stainless steel sleeve bearings turning in extruded hole in frame.

I. Leakage: Class II.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.052-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

L. Master control panel for use in dynamic smoke-management systems.

M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
6. Electrical Connection: 115 V, single phase, 60 Hz.

N. Accessories:

1. Two position indicator switches linked directly to damper blade to remotely indicate damper blade position.

2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.8 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.
5. Approved equivalent.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.040 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch-diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative or Film-lined type with fill material.

   a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.
   b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: None.

J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Lock form and seal or continuously weld joints.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

K. Accessories:

1. Factory-installed end caps to prevent contamination during shipping.
2. Removable splitters.
3. Airflow measuring devices.

L. Source Quality Control: Test according to ASTM E 477.

1. Testing to be witnessed by Architect.
2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

M. Capacities and Characteristics:

1. Configuration: Straight.
2. Shape: Rectangular.
3. Attenuation Mechanism: Acoustical glass fiber or Helmholtz resonator mechanism with no internal media.
4. Maximum Pressure Drop: 0.35-inch wg.
5. Casing:

   a. Attenuation: Standard.
   b. Outer Material: Galvanized steel.
   c. Inner Material: Galvanized steel.

6. End Connection: Flange.
7. Length: Refer to plans.
8. Face Dimension:

   a. Width: Refer to plans.
   b. Height: Refer to plans.

9. Face Velocity: Refer to plans.
10. Accessories:

    a. Birdscreen.

2.9 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.10 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff; a division of PCI Industries, Inc.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed, 2 inches deep.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.

10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.12 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.14 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: R-8.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.15 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, outside-air and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Connect ducts to duct silencers rigidly.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Control devices requiring inspection.
3. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

P. Install duct test holes where required for testing and balancing purposes.

Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 233423
HVAC POWER VENTILATORS

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. Centrifugal roof ventilators.
2. Centrifugal wall ventilators.
3. Ceiling-mounting ventilators.
4. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. 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.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

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. Greenheck.
2. Loren Cook Company.
3. Twin City
4. Penn Ventilation.

B. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Direct Drive Motors:
1. Open type motor enclosure with DC electronic commutation type motor (ECM) specifically designed for fan applications.
2. Motors are permanently lubricated heavy duty ball bearing type to match with the fan load.
3. Motor speed controllable down to 20% of full speed, controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal
4. Motor shall be a minimum 85% efficient at all speeds.

F. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange
2. Overall Height: 14 inches minimum.
3. Pitch Mounting: Manufacture curb for roof slope.

2.2 CENTRIFUGAL WALL VENTILATORS

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. Greenheck.
2. Loren Cook Company.
3. Twin City.
4. Penn Ventilation.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

C. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

D. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Wall Grille: Ring type for flush mounting.
5. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
6. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.3 CEILING-MOUNTING VENTILATORS

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. Greenheck.
2. Loren Cook Company.
3. Twin City.
4. Penn Ventilation.

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Stainless steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Isolation: Rubber-in-shear vibration isolators.
5. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.4 IN-LINE CENTRIFUGAL FANS

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. Greenheck
2. Loren Cook Company.
3. Twin City.
4. Penn Ventilation.

B. Description: In-line, direct-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Direct Drive Motors:
1. Open type motor enclosure with DC electronic commutation type motor (ECM) specifically designed for fan applications.
2. Motors are permanently lubricated heavy duty ball bearing type to match with the fan load.
3. Motor speed controllable down to 20% of full speed, controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal
4. Motor shall be a minimum 85% efficient at all speeds.

F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

G. Accessories:

1. Companion Flanges: For inlet and outlet duct connections.

2.5 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts or restrained spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to plans for installation of roof curbs.

D. Support suspended inline fans and ceiling units from structure using threaded steel rods and elastomeric hangers or spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct

connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 233723
HVAC GRAVITY VENTILATORS

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. Roof hoods.
2. Goosenecks.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.5 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.

E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

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

2.2 FABRICATION, GENERAL

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corporation.
2. Aerovent.
3. Carnes.
4. Greenheck Fan Corporation.
5. JencoFan.
6. Loren Cook Company.
7. PennBarry.

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.

C. Materials: Galvanized-steel sheet, minimum 0.064-inch-thick base and 0.040-inch-thick hood; suitably reinforced.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 16 inches.

E. Bird Screening: Galvanized-steel, 1/2-inch-square mesh, 0.041-inch wire or Stainless-steel, 1/2-inch-square mesh, 0.047-inch wire.

F. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

a. Color and Gloss: As indicated by manufacturer's designations.

2.4 GOOSENECKS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch-thick, galvanized-steel sheet.

B. Bird Screening: Galvanized-steel, 1/2-inch-square mesh, 0.041-inch wire or Stainless-steel, 1/2-inch-square mesh, 0.047-inch wire.

C. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

a. Color and Gloss: As indicated by manufacturer's designations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install gravity ventilators with clearances for service and maintenance.

C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.

E. Label gravity ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION

SECTION 235143
DUST COLLECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes Dust Collection systems with the following accessories:

1. Exhaust fans.
2. Inlet fittings.
3. Dust elimination and collection devices.
4. Accessories.

B. Related Sections include the following:

1. Division 23 “Metal Ducts” for ductwork materials and installation.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer’s literature and data for each type of product indicated. Include rated capacities, dimensions, weights and point loadings, furnished specialties, accessories, electrical requirements and wiring diagrams, and location and sizes of field connections.

B. Operation and Maintenance Data: For dust collection systems to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fans:

1. Performance Ratings: Conform to AMCA 210.
2. Sound Ratings: AMCA 301, tested to AMCA 300.
3. Fabrication: Conform to AMCA 99.

1.5 OPERATION AND MAINTENANCE DATA

A. Operation Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fans: Manufacturer's standard, but not less than five years from date of Substantial Completion.

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. Donaldson Filtration Solutions.
2. Sternvent. (Basis of Design)
3. Scientific Dust Collectors.

2.2 CABINET

A. Cabinet: Single-wall galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation.

B. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on fan sections only.

C. Finish: Heat-resistant, baked enamel.

D. Discharge: Horizontal-pattern, galvanized-steel assembly with diffusers incorporating individually adjustable vanes.

E. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.3 EXHAUST FAN

A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings.

B. Motor: Totally enclosed, single-speed motor.

C. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.

D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with elastomeric isolators.

E. Accessories:

1. Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.
2. Discharge Dampers: Parallel blade heavy duty steel damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.
3. Inlet/Outlet Screens: Galvanized steel welded grid.

2.4 CENTRIFUGAL SEPARATOR

A. Cyclone dust collector consisting of cyclone with integral fan and structural stand incorporation dust storage.

B. Frame and Casing: Steel frame with enamelled finish, 16 gage structure with 18 gage panels and cyclone, two 55 gallon drum dust storage capacity.

C. Cyclone Efficiency: 99 percent of sawdust at 10 microns.

D. Fan: Welded construction centrifugal fan with material handling wheel, direct drive.

1. Capacity: See plans.

2. Motor: 460 volt, three phase, 60 Hz.

E. Accessories: Discharge silencer and Push Button control panel with motor starter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation of dust collector units.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

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

3.2 INSTALLATION

A. Install equipment in accordance with manufacturers instructions.

B. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

C. Install fans with resilient mountings and flexible electrical leads.

D. Install flexible connections at dust collector inlet and discharge. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.

E. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

3.3 CONNECTIONS

A. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect ducts to dust collector units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
   1. Inspect casing insulation for integrity, moisture content, and adhesion.
   2. Verify that clearances have been provided for servicing.
   3. Verify that controls are connected and operable.
   4. Verify that filters are installed.
   5. Inspect and adjust vibration isolators.
   6. Verify bearing lubrication.
   7. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
   8. Adjust fan belts to proper alignment and tension.
   9. Start unit according to manufacturer's written instructions.
   10. Complete startup sheets and attach copy with Contractor's startup report.
   11. Inspect and record performance of interlocks and protective devices; verify sequences.
   12. Operate unit for run-in period recommended by manufacturer.
   13. Inspect dampers, if any, for proper stroke and interlock with other dampers.
   14. Measure and record airflow. Plot fan volumes on fan curve.
   15. Verify operation of remote panel, including fan-operation and failure modes. Inspect the following:

       a. Alarms.

   16. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace malfunctioning components that do not pass tests and inspections and retest as specified above.

D. Prepare written report of the results of startup services.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 235523
GAS-FIRED RADIANT HEATERS

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 gas-fired, tubular infrared radiant heaters.

1.3 SUBMITTALS

A. Product Data: For each type of gas-fired radiant heater indicated. Include rated capacities, operating characteristics, and accessories.

B. Operation and Maintenance Data: For gas-fired radiant heaters to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. 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.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gas-fired radiant heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Burner Igniters: One hot-surface burner igniter(s) for each style of gas-fired radiant heater furnished.

PART 2 - PRODUCTS

2.1 TUBULAR INFRARED HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Calcana Industries Ltd.
2. Combustion Research Corporation.
3. Gas-Fired Products Inc.; Space-Ray Div.
4. Reznor/Thomas & Betts Corporation.
5. Roberts-Gordon, Inc.
6. Schwank Inc.
7. Solaronics, Inc.
8. Sterling HVAC Products; Div. of Mestek Technology Inc.

B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.20/CSA 2.34.

C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Combustion Tubing: 4-inch-diameter aluminized steel with high-emissivity, high-temperature, corrosion-resistant external finish.

E. Tubing Connections: Stainless-steel couplings or flared joints with stainless-steel draw bolts.

F. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-degree tilt from vertical.

1. Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees from vertical.
2. Include hanger kit.

G. Burner Safety Controls:

1. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
2. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
3. Control Panel Interlock: Stops burner if panel is open.

4. Indicator Lights: Burner-on indicator light.

H. Burner and Emitter Type: Gravity-vented power burner, with the following features:

1. Emitter Tube: 4-inch-diameter, aluminized-steel tubing with sight glass for burner and pilot flame observation.
2. Venting: Connector at exit end of emitter tubing for vent-pipe connection.

   a. Vent Terminal: Vertical.

3. Burner/Ignition: Power gas burner with electronic spark and electronic flame safety.
4. Burner/Ignition: Stainless-steel burner cup and head with balanced-rotor draft fan and direct-sensing, hot-surface ignition.
5. Combustion-Air Connection: Duct connection for combustion air to be drawn directly from outdoors by burner fan.

2.2 CONTROLS

A. Thermostat: 2-stage, wall-mounting type with 50 to 90 deg F operating range and fan on switch.

1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.

1. Spring hangers and seismic restraints are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment" and "Vibration and Seismic Controls for HVAC Piping and Equipment."
2. Restrain the unit to resist code-required horizontal acceleration. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Maintain manufacturers' recommended clearances to combustibles.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance.

C. Gas Piping: Comply with Division 22. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Electrical Connections: Comply with applicable requirements in Division 26 Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

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. Report results in writing.

B. Perform tests and inspections and prepare test reports.

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. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

a. Test procedures used.
b. Test results that comply with requirements.
c. 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.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired radiant heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 237413
PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

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 packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Hot-gas reheat.
3. Gas furnace.
4. Economizer outdoor- and return-air damper section.
5. Roof curbs.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during

heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

H. VVT: Variable-air volume and temperature.

I. SZ VAV: Single-zone variable-air volume.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment 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.

C. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs will be attached.
2. Roof openings
3. Roof curbs and flashing.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

C. UL Compliance: Comply with UL 1995.

D. 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.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than 5 years from date of Substantial Completion.
2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
3. Warranty Period for parts: Manufacturer's standard, but not less than 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Carrier Corporation package units or a comparable product by one of the following:

1. Trane.
2. Daikin/McQuay.

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Casing top covers shall be one piece construction or where seams exist, shall be double-hemmed gasket sealed.

B. Exterior Casing Material: Galvanized steel, phosphatized, and finished with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs. Structural members shall be minimum 18 gauge for units up to 10-Ton capacity, 16 gauge for 12.5-Ton capacity or greater. Access doors and removable panels shall be minimum 20 gauge. Cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.

C. Access Panels: Water and air-tight panels with handles shall provide access to filters, heating section, supply air fan section, evaporator coil section and unit control section.

D. Base Pans: Unit base pan shall have a raised 1” high minimum lip around supply and return air openings.

E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1/2 inch.

3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating, foil faced, or faced with a plain or coated fibrous mat or fabric. All insulation edges shall be either captured or sealed.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

F. Condensate Drain Pans: Formed sections of galvanized-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1-2004.

1. Double-sloped.
2. Drain Connections: Threaded nipple both sides of drain pan or one side with reversible drain pan.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.3 FANS

A. Direct-Driven Supply-Air Fans: Plenum fans, backward curved, centrifugal; with self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings. Variable speed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings. Variable speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls. Provide shaft grounding rings for electrical protection.

C. Condenser-Coil Fan: Direct drive, statically and dynamically balanced, draw through, vertical discharge propeller, mounted on shaft of permanently lubricated motor.

D. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless internally finned copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.

B. Outdoor-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless internally grooved copper tube or all aluminum microchannel type in steel casing with equalizing-type vertical distributor.

2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: One or Two.

B. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

C. Refrigeration Specialties:

1. Refrigerant: R-410A or R-407C.
2. Independent Expansion valve with replaceable thermostatic element for each circuit.
3. Refrigerant liquid line filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Cooling capabilities down to 0 deg F standard.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Pleated: Minimum MERV 13.

2.7 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.

1. UL or CSA Approved specifically for outdoor installations downstream from refrigerant cooling coils.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented.

E. Safety Controls:

1. Gas Control Valve: Two stage for units less than 12.5 Ton cooling capacity. Modulating for units equal or greater than 12.5 Ton cooling capacity.
2. Gas Train: Single-body, regulated, redundant, main gas valve assembly, proof of combustion air prior to ignition, continuous flame supervision, flame rollout switches, high temperature limit controls and manual shutoff.

2.8 ECONOMIZER

A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel low leakage dampers. Gear driven so dampers operate simultaneously.

1. Actuator and controls shall be compliant with 2019 T24 California Energy Code.
2. Damper Motor: 0-100% Modulating with adjustable minimum position.
3. Differential Dry bulb temperature control.
4. 2019 T24 California Energy Code compliant Fault Detection Diagnostics, FDD.
5. Relief-Air Damper: Gravity actuated or motorized.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 ACCESSORIES

A. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

B. Coil guards of painted, galvanized-steel wire.

2.11 ROOF CURBS

A. Roof curb manufacturer shall provide seismic calculations stamped and signed by CA licensed SE for pitched curb with factory unit hold down attachments.

B. Materials: Fully welded, galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

   a. Materials: ASTM C 1071, Type I or II.
   b. Thickness: 1-1/2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

   a. Liner Adhesive: Comply with ASTM C 916, Type I.

b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.

c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.

C. Curb Height: As detailed on plans.

D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for wind-load requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

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

3.2 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing per details on plans.

B. Install wind and seismic restraints according to manufacturer's written instructions.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap. Route to drain per plans.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 22 Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply and return ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

3.4 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. Report results in writing.

B. Perform tests and inspections and prepare test reports.

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. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.

5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.

    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.
    d. Measure flue-gas temperature at furnace discharge.
    e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
21. Adjust and inspect high-temperature limits.
22. Inspect economizer and relief dampers for proper operation.
23. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

24. Inspect controls for correct sequencing of heating, economizer dampers, refrigeration, and normal and emergency shutdown.

25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

END OF SECTION

SECTION 237433
OUTDOOR, EVAPORATIVE COOLING MAKEUP-AIR UNITS

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 evaporative cooling rooftop makeup-air units.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories.

B. Startup service reports.

C. Operation and Maintenance Data: For rooftop makeup-air units to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop makeup-air units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Cabinet Leakage: Not less than 10 years from date of Substantial Completion.
   2. Warranty Period for all other Cabinet Components: Not less than 1 year from date of Substantial Completion.
   3. Warranty Period for Evaporative Media: Not less than 2 years from date of Substantial Completion.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Champion
   2. Phoenix.
   3. Greenheck.

2.2 CABINET

A. Construction: Double wall.

B. Exterior Casing: Galvanized (G90) steel 18 gauge, with polyester resin powder paint finish with lifting lugs and knockouts for electrical and piping connections.

C. Interior Casing: Galvanized steel.

D. Base Rails: Galvanized-steel 12 gauge skid rails for mounting on platform.

E. Service Doors: Screwed removable access doors with neoprene gaskets.

2.3 SUPPLY-AIR FAN

A. Fan: Mixed Flow; statically and dynamically balanced, galvanized steel, mounted on solid-steel shaft with self-aligning, permanently lubricated ball bearings.

B. Motor: Open drip proof high efficiency motor.

C. Drive: Direct drive.

2.4 EVAPORATIVE COOLER SYSTEM

A. Evaporative cooler module: Media holder and sump pan shall be fabricated of stainless steel. Gutter and sump shall be sized to supply the system with enough water to operate at its maximum flow rate and not overflow when the system is shut down.

B. Media: 12” rigid CELdek.

C. Water Control: Module shall be equipped with circulating pump, solenoid valves and controls for auto drain and flush cycling.

2.5 OUTDOOR-AIR INTAKE

A. Outdoor-Air Intake Louvers: Galvanized steel, with bird screen complying with ASHRAE 62.1-2004 and finish to match cabinet.

2.6 CONTROLS

A. Factory-wire connection for controls' power supply.

B. Control devices, including sensors, transmitters, relays, switches, thermostats, humidistats, detectors, operators, actuators, and valves, shall be manufacturer's standard items to accomplish indicated control functions.

C. Remote-Mounted Status Panel:

1. Cooling/Off/Vent Controls: Control operational mode.

2.7 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation of rooftop makeup-air units.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where rooftop makeup-air units will be installed.

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

3.2 INSTALLATION

A. Install wall- and duct-mounting sensors, thermostats, and humidistats furnished by manufacturers for field installation. Install control wiring and make final connections to control devices and unit control panel.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply ducts to rooftop makeup-air units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.4 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for visible damage to cabinet, media, fan assembly and water controls.
2. Verify that clearances have been provided for servicing.
3. Verify that controls are connected and operable.
4. Verify that media is installed.
5. Verify bearing lubrication.
6. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
7. Adjust fan belts to proper alignment and tension.
8. Start unit.
9. Start evaporative cooler system and verify operation of circulating pump, water distribution and operation of auto drain and flush solenoids.
10. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
11. Operate unit for run-in period.

B. After startup and performance testing, clean media, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

D. Prepare written report of the results of startup services.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain rooftop makeup-air units. Refer to Division 01 Section "Demonstration and Training."

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. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 COORDINATION

A. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 07 Section "Roof Accessories."

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: Five years from date of Substantial Completion.

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. Carrier.
2. Mitsubishi.
3. Daikin AC.

2.2 CONCEALED EVAPORATOR-FAN COMPONENTS

A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2004.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Disposable Filters: 2 inch thick, in fiberboard frames with ASHRAE 52.2 MERV rating of 13 or higher.

F. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.3 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Heavy duty ABS and high impact polystyrene plastic with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2004.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Permanent, cleanable.

2.4 CEILING-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2004.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. 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 overcurrent protection.

D. Fan: Direct drive, centrifugal fan and integral condensate pump.

E. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

F. Filters: Permanent, cleanable.

2.5 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. 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.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Twin Rotary.
2. Digitally controlled inverter driven compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
3. Refrigerant: R-407C or R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F.

H. Mounting Base: Polyethylene.

I. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings."

2.6 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 25 “Direct Digital Control and Energy Management System.”

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

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.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. 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.

1. Minimum Insulation Thickness: 1 inch thick where indoors, 1-1/2” thick with aluminum jacketing where outdoors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounting compressor-condenser components on equipment supports as specified on the drawings. Anchor units to supports with removable, cadmium-plated fasteners.

D. Install seismic restraints.

E. Install and connect precharged 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.

B. Install piping adjacent to unit to allow service and maintenance.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal 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."

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

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.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

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, apply to this section.

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 and Specifications listed below.

1. Specifications:

Section	Title
260000	Summary of Electrical Work
260100	General Conditions for Electrical Work
260500	Basic Electrical Materials and Methods
260526	Grounding
261300	Medium Voltage Distribution
261340	Cable Trays
262213	Dry Type Transformers (600V or Less)
262413	Switchboards
262416	Panelboards
265113	Lighting
266100	Lighting Control Systems
269500	Electrical Acceptance Tests
270000	Communications
270526	Grounding and Bonding for Communications Systems
270600	Schedules for Communications
271100	Communications Equipment Room Fittings
271113	Communications Entrance Protection
271116	Communications Cabinets, Racks, Frames, and Enclosures
271119	Communications Termination Blocks and Patch Panels
271513	Communications Copper Horizontal Cabling
271543	Communications Faceplates and Connectors
271553	Communications Cable Plant Testing
280000	Electronic Safety and Security
284600	Intelligent Addressable Fire Alarm System

B. The sections listed above include 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 CEC 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. Demolition and Phasing:

   a. De-energize, disconnect and remove electrical feeds to devices and equipment being removed or relocated.

   b. Disconnect and remove existing electrical facilities in areas of remodel and demolition that are not to be reused.

   c. Make temporary feeds and connections to areas and equipment to allow phased construction and continuing operation.

2. Electrical Distribution:

   a. Power distribution system, as shown, complete with switchboards, transformers, panelboards, conduits, feeders, pull boxes, fittings and related equipment and equipment pads.

   b. Trenching, conduits and feeders for electrical power including connections to relocatable buildings.

3. 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 the 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 ¾ 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. Testing of grounding system as outlined in Section 269500, “Electrical Acceptance Tests”.

4. Signal Distribution:

a. Trenching, conduits and conductors for signal systems.

b. Building mounted conduits and conductors for signal systems.

c. Trenching and conduits for control systems as required by Division 21-25 Specification Sections.

5. Building Electrical and Mechanical Systems:

a. Complete system of branch circuit wiring, conduit and distribution equipment for lighting, receptacles and power.

b. Electrical work associated with mechanical equipment, including conduit, conductor, disconnect switches and motor starters.

c. Furnish roof jacks for the weatherproofing of each electrical conduit penetrating the roof. Roof jacks shall be of the material specified for the specific roofing system and shall be delivered to the general contractor/construction manager for installation by the roofing contractor.

d. Connection to all equipment as furnished by other Sections of these Specifications or as listed on Drawings as furnished by Owner.

6. Lighting:

a. Provide complete lighting system including fixtures, hangers, lamps, wall switches and lighting controls.

b. Provide complete Lighting Control System consisting of motion sensors, timer switches and other controls as shown in Drawings.

7. Telecommunication Distribution System

a. Complete Telecommunication Distribution System per Division 27 Specifications

8. Electronic Safety and Security System

a. Complete Electronic Safety and Security System per Division 28 Specifications

9. Video Surveillance System

a. Complete Electronic Access Control System per Division 28 Specifications

10. Fire Alarm System:

a. Complete Fire Alarm system per Specification Section 284600, “Fire Alarm System”, including Fire Alarm Control Panels, Signal Expander Panels, initiation devices, signal devices, control devices, annunciators, access panels, terminal cabinets, conduit, wiring and terminations and equipment for a complete working system.

b. Installation of two (2) Type RJ31X Telephone Jacks at Fire Alarm Control Panel location and wiring back to Main Telephone Backboard.

11. 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.

12. Equipment Connections

a. Provide equipment connections and coordination in accordance with manufacturer’s recommendations and product submittals.

b. Provide equipment connections and disconnect switches as required for the following equipment:

1) Mechanical equipment.

2) Owner furnished equipment.

E. Work specifically excluded from this Division.

1. Furnishing of motors.

F. It shall be understood that the existing conduit with its wiring is presently active (hot), in operation with its pertinent equipment.

G. It shall be noted that this construction work will be planned and executed during ongoing operation of the facility. Any modifications to the existing equipment currently in operation shall be done during scheduled shutdowns and coordinated with the Owner's authorized representative and facility operating personnel to assure minimum downtime.

H. In order to avoid disruption to facility operations, certain items of work must be completed before other items of work can be started. Contractor shall coordinate with the Owner's authorized representative as to the sequence of construction activities.

I. Coordinate with the civil engineer to locate the concrete pad and the knock out box in the pad for the high voltage conduits and electrical power circuits.

J. 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.

K. 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.

L. Size, furnish, install and connect new conduit, conduit fittings, and seal fittings, expansion fittings and supports. This includes above grade as well as underground.

M. Size, furnish, and install junction, pull and terminal boxes, in accordance to code requirements and as shown on the construction drawings.

N. 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.

O. 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.

P. Furnish and install permanent "DANGER - HIGH VOLTAGE" warning signs for the outdoor and indoor switchgear, all unit substations, motor control centers, power distribution panels, and on all doors of all electrical equipment rooms, fenced yards, etc.

Q. Furnish and install markers indicating voltage levels (e.g., 4.16 KV, 277/480V, 120/208V, etc.) for all of the electrical equipment such as motor control centers, local lighting panels, lighting transformers, power panels, switchboards, etc....

R. 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.

S. 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.

T. Furnish, install and connect all power, control and instrumentation cable, including all necessary cable lugs, connectors and terminations.

U. Perform all testing per the Specifications (including generator cables) and report to Owner's field representative in a timely manner so as not to impede the scheduled completion of the Contract.

V. Furnish all material, labor and testing equipment necessary to check out and test the complete power distribution, control and pneumatic systems for all process and utility equipment in strict accordance with specifications. This shall include check out/start up of systems and/or equipment as directed by Owner.

W. Prime paint all uncoated carbon steel items furnished by Contractor.

X. Energize low voltage services after testing equipment and wiring in accordance with manufacturer instructions and specifications.

Y. Provide four ¾” 10 ft copper ground rods and Cadweld the ground rods to a bare copper #4/0 conductor to form a ground ring. Install one ground ring around the service transformer and one ground ring around the medium voltage switch.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION 260000

FOR BID ONLY

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, apply to this section.

1.2 SUMMARY

A. Section Includes

1. This section includes the general conditions and required methods for the contractor to furnish and install the complete electrical system as well as furnish and install the electrical connections to equipment.

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. 2019 California Building Code.
3. 2019 California Fire Code.
4. 2019 California Electrical Code.

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 services. This shall include any required street lighting charges.

1.5 EXISTING CONDITIONS

A. The Contractor shall carefully examine the site and existing buildings, compare them 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. Any work done as an addition, expansion, or remodel of an existing system shall be compatible with that system.

C. 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.

1.6 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.

1.7 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.

1.8 SUBMITTALS

A. See Specification Section 013300, SUBMITTAL PROCEDURES, for additional information and requirements.

B. 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 in a suitable binder or electronically as PDF files. The submittal shall include a Title Sheet including Project, Engineer and Contractor, Table of Contents, and indexed tabs, or bookmarks if submitting electronically, 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 approves the submittal. 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.

C. Submittal Review

1. Refer to Specification Section 013300, SUBMITTAL REQUIREMENTS, ARCHITECT'S REVIEW & ACTION, AND COST FOR MULTIPLE RESUBMITTALS all Shop Drawings and Product Data submittals**.**

2. 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.

3. 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.

4. 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.

5. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

D. Substitutions

1. See Specification Section 012500, SUBSTITUTION PROCEDURES, for additional information and requirements.

2. 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.

E. Record Drawings

1. See Specification Section 017839, PROJECT RECORD DRAWINGS, for additional information and requirements.

2. In addition to the provisions of Specification Section 017839, PROJECT RECORD DRAWINGS, 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.

F. Operations and Maintenance Instructions

1. See Specification Section 017823, OPERATION AND MAINTENANCE DATA, for additional information and requirements.

2. In addition to the provisions of Specification Section 017823, OPERATION AND MAINTENANCE DATA Operations and Maintenance Instructions shall comply with the following requirements:

a. Three copies of Operation and Maintenance Instructions and Wiring Diagrams and an electronic PDF 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 (e.g. UPS-1). 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 and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. MCC, UPS, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.

c. The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The Engineer's office shall be notified 48 hours prior to this meeting.

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.

1.9 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.

1.10 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.

1.11 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 ¾” 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 2019 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 weighting 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 weighting 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.

      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 2019 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 or they shall comply with one of the HCAI Pre-Approvals (OPM#) as modified to satisfy anchorage requirements of ACI 318, Chapter 17.

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

BASIC ELECTRICAL MATERIALS AND METHODS

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. This section includes basic electrical materials and methods for installing raceways and fittings, concrete pads, pull boxes and manholes, conductors and wires, wiring devices, terminal cabinets, panelboards, protection devices, and identification of those devices.

1.3 STANDARDS

A. NEMA 250 — Standard for Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260100 “General Conditions for Electrical Work”.

PART 2 - PRODUCTS

2.1 CONCRETE PADS, PULL BOXES AND MANHOLES

A. At the Contractor’s option, 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 2500-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”, “Fiber Optic”, “Danger-High Voltage”, 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-tight type compression fittings where required and rain-tight wet location listed compression fittings for outdoor 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 METAL CLAD CABLE (TYPE MC)

A. Type MC Cable shall consist of 3 or more individually insulated 600V THHN/THWN conductors, an overall polypropylene cable assembly tape and an outer galvanized steel or aluminum interlocked armor.

B. Type MC Cable shall have as one of its conductors a separate full sized equipment grounding conductor as the armor is not considered an equipment grounding means.

C. Type MC Cable fittings shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.

2.4 METAL CLAD CABLE (TYPE MC-PCS)

A. Type MC-PCS Cable shall consist of 3 or more individually insulated 600V THHN/THWN copper conductors not less than #12 AWG + 2 additional insulated 600V THHN/THWN #16 AWG copper conductors separately contained within a PVC jacket. All conductors shall be contained within an overall polypropylene cable assembly tape and an outer galvanized steel or aluminum interlocked armor.

B. Type MC-PCS Cable shall have as one of its conductors a separate full sized equipment grounding conductor as the armor is not considered an equipment grounding means.

C. Type MC-PCS Cable fittings shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.

2.5 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. Conductors for systems rated less than 600-volts 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 may be solid or stranded copper “THWN/THHN”, 600-volt insulation. The secondary service feeder between new Transformer ‘TMV’ and the main building Panel ‘DPS’ shall have XHHW-2, 600-volt insulation.

C. Insulation shall be rated at 75 degrees C. minimum.

D. Medium voltage conductors shall be as specified in Section 261300 Medium Voltage Distribution.

2.6 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.

2.7 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 UL listed and shall be attached to box with threaded metal screws. Outlet boxes and/or box extensions shall be flushed with the wall finished. “Flash Guards” shall be install at locations where the outlet box or extension is not made flush with the wall finish.

C. Approved manufacturers of metal boxes are Circle AW, Crouse-Hinds, Steel City or equal.

D. Floor Boxes and Fittings

1. Recessed flush floor box type shall be the Wiremold #RFB9-OG series rated for slab on grade installation. Floor boxes shall be provided with hinged lids that accommodate cable egress and where flooring surrounding the floor box is carpet the lid shall be the carpet cover type with a carpet cut-out area. Floor boxes located in areas of LVT flooring shall have the flush tile type lid.

2. Floor boxes shall include device plate to accommodate the specified outlet device types. Any unused device outlet locations shall be provided with blank device plates.

E. A/C Snap Switches:

1. 120/277 Volt Switches shall be quiet, fast make, fast break design, toggle handle, with totally enclosed case, rated 20 ampere, heavy duty specification grade. Provide matching two pole, 3-way, 4-way, and key switches as required.

2. A/C snap switches served by emergency power circuits shall be red.

3. A/C snap switches shall be Hubbell or Leviton 1221 series.

F. 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 served by normal power circuits shall be ivory, grey, white or brown, dependent upon room wall finish and as direct by Architect. Receptacles served by emergency power circuits shall be red.

c. Duplex receptacles shall be Hubbell HBL5362WTR series, or equivalent.

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. TVSS Receptacles:

   a. TVSS Receptacles shall be Decora Plus duplex, straight blade, industrial grade, self-grounding, surge protected with indicator light, rated at 20 amperes, 125-volts.

   b. TVSS Receptacles shall have integral TVSS with line-to-ground, line-to-neutral, and neutral-to-ground surge protection, with a nominal clamp level rating of 500 volts and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.

   c. TVSS Receptacles shall be Hubbell HBL5362WSA series, or equivalent.

4. 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 2019 California Energy Code Section 130.5(d). Controlled receptacles shall be permanently factory marked with the symbol shown in 2019 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.

5. 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.

6. Required Tamper-Resistant Receptacles: Tamper resistant receptacles shall be provided in the following areas where required by CEC 406.12:

   a. Dwelling units;

   b. Guest rooms and guest suites;

   c. Child care facilities;

   d. Preschool and elementary school education facilities;

   e. Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities;

   f. Subset of assembly occupancies described in CEC 518.2 to include places of waiting transportation, gymnasiums, skating rinks and auditoriums;

7. Receptacles for Owner-furnished equipment shall match that equipment’s plug configuration.

8. Other Receptacles: Other receptacles shall match the plug configuration and ratings required for the utilization equipment that is served.

G. 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”. Cover plates installed at switches used for lighting control in all multiple occupant restrooms, all hallways and corridors, and in other locations where lockable cover plates are indicated on the Drawings shall be the dustproof locking stainless steel cover Legrand model WP26-L.

2.8 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.

2.9 PANELBOARDS

A. Furnish panelboards shown on plans and described herein. All cans shall be a minimum of 20” wide and 5.75” deep unless otherwise shown. They shall be totally flat or equal with flush keyed locks.

B. Fronts shall be cold rolled sheet steel painted with ANSI 61 gray enamel over a rust inhibitor. They shall be equipped with door, flush hinges, and flush proper cylinder tumbler lock, metal circuit card holder, and quarter turn adjustable trim clamps. Panel locks shall be keyed alike.

C. Panel shall consist of reinforced corrosion resistant galvanized sheet steel frame with silver plated copper bus bars and circuit breakers properly supported to prevent vibration breakage in handling. All terminals shall be solderless type suitable for specified conductors of size indicated.

D. Neutral bus shall be full size. Neutral bus shall be 200% rated when supplied from a double neutral feeder. Provide an equipment ground bus in each panelboard. In addition to the equipment ground bus, provide an isolated ground bus when supplied from a feeder which includes an isolated grounding conductor.

E. Branch circuit breakers shall be molded case, bolt-on, and fully interchangeable without disturbing adjacent units. All 2-pole and 3-pole breakers shall have common trips. Circuit breakers supplying Class 1 transformers shall be lockable in the off position.

F. Branch panelboards and overcurrent protection devices shall have a minimum short circuit rating of 22,000 RMS symmetrical AIC (120/208V).

G. Distribution panelboards and overcurrent protection devices shall have a minimum short circuit rating of 42,000 RMS symmetrical AIC (120/208V).

H. All Panelboards shall be fully rated as shown on Drawings; series-rating shall not be allowed.

I. Panelboards shall bear an Arc-Flash Hazard Warning label in accordance with CEC Article 110.16.

J. Breakers for switching lights shall be type SWD, rated for switching duty. Breakers for mechanical equipment shall be HACR type.

K. All spaces shall have hardware.

2.10 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.

2.11 FUSES

A. Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Bussman
2. Gould Shawmut
3. Littlefuse.

B. Fuses 600 amperes and below shall be UL Class RK1, 200,000 RMS symmetrical amperes interrupting rating.

C. Fuses 601 amperes through 4000 amperes shall be UL Class L, 200,000 RMS symmetrical amperes interrupting rating.

2.12 INDIVIDUAL MOTOR CONTROLLERS:

A. Individual Motor Controllers shall be self contained in NEMA 1 gasketed enclosure (NEMA 3R where installed outdoors) and externally operable from the front.

B. Individual Motor Controllers shall be full-voltage non-reversing (FVNR) type combination magnetic starters for motors of ½ HP to 60 HP. Individual Motor Controllers shall be reduced voltage, non-reversing, autotransformer type combination magnetic starters for motors 75 HP and larger.

2.13 MAGNETIC STARTERS FOR MECHANICAL EQUIPMENT

A. All magnetic starters for mechanical equipment shall be furnished with integral 120VAC control transformers, sized to handle the starter and all controls connected to it – pilots, EP valves, etc.

B. All magnetic starters for mechanical equipment shall be provided with auxiliary contacts as required for interlock to EMS System. An allowance of at least one auxiliary contact per starter shall be estimated.

2.14 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.

2.15 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. Arc-Flash Hazard Warning labels shall be provided at electrical equipment such as switchboards and panelboards in accordance with CEC 110.16.

L. 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.

M. 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).

2.16 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 Raceway Installation:

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 3, CEC.

C. Exterior Raceway Installation:

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. Underground Raceway Installation:

1. Two or more power or telecommunications conduit runs installed in a common trench shall be separated horizontally by a minimum of four inches (4”).

2. Two or more power and telecommunications conduit runs installed in a common trench shall be separated horizontally by a minimum of twelve inches (12”).

3. All electrical conduit runs installed in a common trench with other utility company lines, plumbing pipes, or heating pipes shall be separated horizontally from such lines by a minimum of twelve inches (12”).

4. Conduits installed underground and not under buildings shall have a minimum of 24” of cover over the top of the conduit.

5. Utility service conduits shall be installed according to the serving utility's requirements for material, depth of cover, and separation.

6. Rigid non-metallic conduit shall be laid on excavated firm bed, sealed watertight and unless with 24 inch earth cover, shall have 3 inch minimum concrete encasement unless under concrete. Plastic conduit without encasement shall be random lay, "snaked", not pulled tight. Plastic conduit laid in areas of reinforcing steel shall be supported independently at each threaded fitting. Plastic conduit joints shall be full solvent welded.

7. Rigid non-metallic conduit installed underground and not below a building slab shall have a galvanized rigid steel long radius elbow installed at the terminating end where the transition from horizontal to vertical occurs.

E. Raceway Installation: In Concrete Slabs

1. Conduit installed within concrete slabs shall be Schedule 80 PVC rigid non-metallic conduit or full weight galvanized rigid steel conduit.

2. Conduits in concrete slabs 3 inches thick or less shall not be of size larger than ¾ inch nominal trade size, and wired to top of reinforcing steel.

3. Conduit installed in concrete slabs shall be installed in the middle third of the slab thickness where practical, and have at least 1-inch concrete cover.

4. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

5. Conduit installed in concrete slabs shall be installed side-by-side horizontally and shall have no less than 1" spacing between each conduit to allow for concrete consolidation to prevent voids in the concrete. Conduits that are installed in concrete slabs shall be arranged such that they do not cross over other conduits within the concrete slab. Where crossing of conduits is unavoidable the crossing sets of conduits shall be installed below the slab. No more than 3 conduits shall be installed side-by-side in a concrete slab without special permission from the structural engineer.

6. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

7. Contractor shall be responsible for damages to membrane and shall repair it.

F. Raceway Installation: 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.

G. Raceway Installation: 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.

H. Raceway Installation: In Beams and Footings

1. Conduit in concrete beam and footings shall be perpendicular to direction of beams unless otherwise indicated on structural drawings.

2. Conduit shown in concrete beam parallel to beams shall be installed at approximate mid-depth of beam.

I. Flexible Conduit Raceway Installation:

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 METAL CLAD TYPE MC CABLE APPLICATION

A. Branch circuits may be Type MC cable only where they are completely concealed within walls or above ceilings.

B. Type MC cable shall not be permitted for feeders.

C. Type MC cable shall not be permitted underground.

3.6 METAL CLAD TYPE MC-PCS CABLE APPLICATION

A. Lighting branch circuits may be Type MC-PCS cable only where they are completely concealed within walls or above ceilings.

B. Type MC-PCS cable shall not be permitted for branch circuits other than the controlled lighting branch circuits of individual spaces.

C. Type MC-PCS cable shall not be permitted for feeders.

D. Type MC-PCS cable shall not be permitted underground.

3.7 METAL CLAD CABLE – INSTALLATION

A. Install metal clad cable in accordance with manufacturer's instructions and in strict accordance with CEC Article 330. Follow manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over tightened. Connector shall be firmly attached to metal boxes.

B. Support metal clad cables every 6 feet and within 12 inches of boxes, per CEC Article 334, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Metal clad cables shall not be bundled together.

C. Suspended ceiling drop wire may be used to directly support a maximum of two separate metal clad cables.

D. Provide separate drop wire above accessible ceiling, to support more than two metal clad cables.

E. Do not rest metal clad cables on ceiling tiles or allow contact with mechanical piping systems.

F. Bend metal clad cable per CEC Article 334.

G. Provide separate sleeves and/or fire barriers where metal clad cable penetrates firewalls, unless cable is UL listed for the application.

3.8 CONDUCTOR APPLICATION

A. Feeders and branch circuits shall be Type THHN/THWN insulated conductors in raceway.

B. The underground secondary service feeder between Transformer 'TMV' and the building main Panel 'DPS' shall be Type XHHW-2 in non-metallic Schedule 40 PVC conduit.

C. Branch circuits for other than lighting circuits shall be Type THW or THHN/THWN insulated conductors in raceway. 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.

D. Minimum conductor size shall be #12 for power and lighting, #14 for 120V control circuits and #18 for 24V control circuits.

E. 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.

3.9 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.

3.10 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.

3.11 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.

3.12 WIRING DEVICES AND MATERIALS

A. Outlets shall be mounted at 18” minimum above finished floor unless otherwise noted.

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 C.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 rated for installation on grade, brushed aluminum 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. Devices and outlet boxes for outlets mounted on slatwall wall finishes shall be provided with flash guards.

Q. Boxes shall be sized for number of conductors entering box.

R. 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.

S. All device screw slots shall be left in a vertical orientation.

T. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor and to outlet box with bonding jumper.

3.13 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.

3.14 PANELBOARDS

A. All panels shall have, in addition to conduit shown on the drawings, two ¾" and three 1" conduits stubbed to nearest accessible attic space.

B. All panels shall be installed with the top of the trim at 6'-0" above the finished floor, unless otherwise indicated on the drawings.

C. Where space permits, panels shall be surface mounted where they are not visible to the public.

D. A typewritten directory shall be mounted behind plastic in a metal holder welded to the inside of each panel door showing circuit numbers and complete description of all outlets on each circuit and an Arc-Flash Hazard Warning label shall be applied to each panelboard, switchboard and service entrance in accordance with CEC 110.16.

E. Labeling of all circuits at panel boards shall match the exact room names of each of the spaces. Verify exact room names with Owner prior to labeling.

F. Electrical loads shall be disaggregated into separate panelboards per the 2019 California Energy Code Section 130.5(b).

3.15 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 NEC 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.

3.16 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.

3.17 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.

3.18 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.

N. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.19 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.

3.20 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.

D. See Section 09900, "Painting".

3.21 SYSTEM TESTING AND STARTUP

A. Refer to Specification Section 269500 "Electrical Acceptance Tests" for minimum required systems testing and startup.

3.22 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 260526
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, apply to this Section.

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 Specification Section 260100 “General Conditions for Electrical Work”.

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 TELECOMMUNICATION MAIN GROUND BUS

A. Telecommunication main ground bus: 4”W x 1/4”H x 12”L UL listed and pre-assembled telecommunication main ground bus consisting of bare annealed-copper bar having pre-drilled hole patterns to accommodate two-hole lugs and with two 3/8” diameter mounting holes spaced 5.75” apart, 2-insulators, 2-stainless steel stand-off brackets, 4-stainless steel bolts, 4-lock washers and 4-flat washers + lug kit. Chatsworth model 40158-12, or equivalent.

2.5 TELECOMMUNICATION GROUND BUS

A. Telecommunication ground bus: 2”W x 1/4”H x 12”L UL listed and pre-assembled telecommunication ground bus consisting of bare annealed-copper bar having pre-drilled hole patterns to accommodate two-hole lugs and with two 3/8” diameter mounting holes spaced 5.75” apart, 2-insulators, 2-stainless steel stand-off brackets, 4-stainless steel bolts, 4-lock washers and 4-flat washers + lug kit. Chatsworth model 40156-12, or equivalent.

2.6 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.

2.7 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.

2.8 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, enclosures 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.

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. Provide a grounding electrode system at each building per CEC 250.50.

D. Provide ground rings at Transformer 'TMV' and the medium voltage switch.

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. Feeders and branch circuits shall be provided with an insulated grounding conductor run with the circuit conductors. This grounding conductor shall be in addition to the ground path provided by the continuously grounded metallic raceway system that encloses the phase and neutral conductors.

4. 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.

5. Install separate Equipment Grounding Conductor in branch circuit runs from computer area power panels or power-distribution units.

C. Air-Duct Equipment Circuits

1. Install an Equipment Grounding Conductor to duct-mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.

D. Water Heater, Heat-Tracing, and Anti-frost Heater Circuits

1. Install a separate Equipment Grounding Conductor to each electric water heater, heat-tracing assembly, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Signal and Communication Systems

1. For telephone, alarm, voice and data, and other communication systems, provide a No. 3/0 AWG minimum insulated copper grounding conductor in raceway from the building grounding-electrode system to a telecommunication main ground bus at the building telecommunication service entrance telephone backboard.

F. IDF Cabinets, and Remote Telecommunication Cross Connect Rooms

1. IDF Cabinet shall have a telecommunication ground bus installed within the cabinet and the telecommunication ground bus shall be connected to the telecommunication main ground bus with a No. 4 AWG minimum insulated copper grounding conductor installed within a raceway.

G. Terminal Cabinets

1. Terminate grounding conductor on cabinet grounding terminal.

H. 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 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes:

1. Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor.

2. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall.

3. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

B. Connections to Manhole Components:

1. Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole, to ground rod or grounding conductor.

2. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor.

3. Train conductors level or plumb around corners and fasten to manhole walls.

4. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.6 FIELD QUALITY CONTROL

A. Refer to Specification Section 269500 “Electrical Acceptance Tests” for minimum required testing of Grounding System.

3.7 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 260301
MEDIUM VOLTAGE DISTRIBUTION

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. Furnish and install underground medium voltage duct system including, pull boxes, conduit, red-dyed concrete encasement, grounding.

B. Furnish, install, connect, test and place into service all medium voltage cable and terminations as described in the Specifications and Drawings.

1.3 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260010 “General Conditions for Electrical Work”.

B. Product Data

1. The Contractor shall submit for approval with full description of primary cable and terminations.

C. Certification of the Qualifications of High Voltage Cable Installers

1. The Contractor shall submit a certification, to and for the approval of the Architect, that contains the names and the qualifications of persons recommended to perform the termination of high voltage cables approved for installation under this contract.

2. The certification shall indicate that persons recommended to perform actual terminations have been adequately trained in the proper techniques and have had at least 5 recent years of experience in terminating the same or similar types of cables approved for installation.

D. Test Reports

1. Submit field tests reports indicating and interpreting test results specified in Part 3 of this Section.

E. Operation and Maintenance Data

1. Submit operation and maintenance data for Medium Voltage equipment to include in Operation and Maintenance Manuals specified in Division 1 Specification Section 017823.

1.4 QUALITY ASSURANCE

A. Cable shall be installed by Contractor with five or more years demonstrated experience installing 5 KV cable.

B. Cables shall be spliced, terminated and tested by a contractor specializing in 5 KV cable splicing.

1.5 UTILITY COMPANY REQUIREMENTS

A. Comply with all serving utility companies' requirements prior to any work.

PART 2 - PRODUCTS

2.1 MEDIUM VOLTAGE CONDUIT

A. 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.

2.2 MEDIUM VOLTAGE VAULTS

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 3 Section "Cast-in-Place Concrete".

C. Concrete shall be 3500-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place concrete".

D. Vaults in vehicular traffic areas shall have full traffic rated torsion assist covers.

2.3 MEDIUM VOLTAGE CABLE

A. Cables shall meet the latest requirements of UL 1072, AEIC CS6, NEMA WC8/ICEA S-68-516 for power cables with Ethylene Propylene Rubber insulation.

B. Cables shall be single conductor rated 5KV (133 percent insulation) and UL listed as Type MV-105.

C. Cables shall be capable of operating continuously in both wet and dry locations at a conductor temperature of 105 degrees C for normal operations, 140 degrees C under emergency operating conditions, and 250 degrees C under short-circuit conditions. Cable shall be suitable for use in metallic and non-metallic conduits or ducts.

D. Conductor shall be compact stranded round annealed uncoated copper per ASTM B-496.

E. Strand screen shall be extruded semi-conducting EPR and shall meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

F. Insulation shall be heat, moisture, ozone and corona resistant ethylene propylene rubber compound, contrasting in color from the strand screen and the insulation screen per AEIC CS6. Thickness shall be 115 mils nominal, with minimum thickness at any point no less than 90 percent of nominal. The insulation shall contain no polyethylene.

G. Insulation Screen shall be extruded semi-conducting EPR and shall meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

H. Shield shall be spiral wrapped bare copper tape, 5 mil minimum thickness, with minimum 12.5% overlap.

I. Jacket shall meet or exceed electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682 and UL 1072 for polyvinyl chloride jackets.

J. Medium voltage cable shall be Okonite-Okoseal MV-105, or equal.

2.4 FIRE PROOFING TAPE

A. Fireproofing tape shall be 3m, Scotch 77, Raychem, or equal.

2.5 MEDIUM VOLTAGE TERMINATIONS

A. Terminal all cables at S&C Vista Underground Distribution Switch with elbows. Non-load break elbows shall be Elastimold #156LR for 200A and #K656LR for 600A (or an approved equal) rated for 15KV.

B. Provide a strain relief segment, per manufacturer's installation instructions, for cables that are attached to the switchgear in order to minimize the load on the bushings. Arrange and terminate cables in a manner that avoids applying a force load on the bushings and bushing wells.

C. Replace all shipping covers on all bushing and bushing wells of the S&C Vista Underground Distribution Switch with elbows or insulated protective caps per manufactures installation instructions.

D. Match existing cable terminations for terminations at existing service entrance switchgear and existing chiller yard sub-station.

2.6 MEDIUM VOLTAGE PADMOUNTED TRANSFORMERS

A. General

1. Furnish and install one medium voltage pad mounted transformer designed, built and tested in accordance with the latest revision of all applicable standards of IEEE, NEMA, and ANSI and as follows:

2. Transformer shall be designed for outdoor application at altitudes not to exceed 3,300 feet, in an ambient not exceeding 40°C maximum and average ambient for any 24-hour period not exceeding 30°C.

B. Manufacturer

1. ABB, or approved equivalent.

C. Ratings

1.	Frequency:	60 Hertz
2.	KVA:	See Drawing
3.	Impedance:	3.5% min. – 5.75% max.
4.	Primary Voltage:	12.47KV Δ
5.	Primary Taps:	-5%, -2.5%, 2.5%, +5% (FCAN & FCBN)
6.	Primary B.I.L.:	60KV
7.	Secondary Voltage:	277/480V, 3∅, 4 W Y.

8. The transformer shall carry its continuous rating with average winding or temperature rise by resistance that shall not exceed 65°C above 30°C ambient.

D. Construction

1. The transformer tank and terminal compartment shall be bolted together to form an integral unit of the outdoor weatherproof type. The terminal compartment shall be completely enclosed with one high voltage and one low voltage compartment door. There shall be no bolts, screws or other fastening devices which are externally removable (with the exception of pentahead or hex head bolts for security) that provide access to the energized parts within the enclosure. The enclosure shall be tamper-resistant design meeting the requirements of the Western Underground Committee Guide No. 2-13 “Security for Pad-Mounted Equipment Enclosures”.

2. Full height, air-filled incoming and outgoing terminal compartments with hinged doors shall be located side by side, separated by an isolating barrier. The doors shall be attached with stainless steel hinges and hinge pins and incorporates a 3-point latching mechanism operated by the low voltage door handle, with doorstops on both doors to secure doors during servicing. To facilitate making connections and permit cable pulling, the doors and compartment hood shall be removable. A removable doorsill shall be provided to permit rolling or skidding unit into place over conduit stubs in foundation.

3. The incoming compartment shall be on the left, and shall be accessible only after the door to the outgoing compartment has been opened. The incoming compartment shall enclose the high voltage Universal-bushing wells and provide for incoming cable from below. The incoming line equipment shall be arranged for type of cable feed as shown on drawings.

4. The outgoing line compartment shall be arranged for cabling from below. Three line bushings and one insulated neutral bushing with an externally removable ground strap shall be supplied. The bushings shall be supplied with spade type terminations with standard NEMA spacing and drilling.

5. Transformer cooling fluid shall be FR3 Envirotemp Natural Ester cooling fluid.

E. Standard Accessories

1. A weather cover over the cabinet is to be provided with additional hold-down hardware to secure it more firmly to the cabinet.

2. Four lifting hooks.

3. Bolted-on terminal compartment minimum of 18” deep with removal front sill.

4. Hinged, lift-off cabinet doors.

5. Interlocked hex-head or penta-head bolt/padlock handle to operate a cam assembly, which is to be part of the 3-point door latching mechanism.

6. Dead front construction, with externally clamped high voltage Universal-bushing wells with non-loadbreak 200-ampere inserts. Contractor to provide non-loadbreak elbows for the size and type cable shown on the drawing.

7. Lightning arrester mounting pads.

8. Tank ground pads (1 in HV – 1 in LV).

9. Steel high/low voltage compartment barrier.

10. Two 3/8” hex-head bolts, which must be removed, from the flange formed on the steel high/low barrier before the H.V. door can be opened.

11. Externally clamped low voltage epoxy bushings with threaded copper studs and NEMA 8-hole rotatable spades.

12. Nameplate.

13. Fill plug and self-actuating pressure relief device.

14. Drain plug.

15. Removable neutral ground strap.

16. Handhole cover bolted onto tank top (protected by weather cover).

17. Tap changer handle for de-energized operation only.

18. Drain valve with sampling device.

19. Liquid level gauge.

20. Dial type thermometer.

21. Pressure vacuum gauge.

F. Paint Finish

1. The paint finish total film thickness applied shall be 3.0 MIL thick as determined by testing per U.P.A. Technology MINIDERM S-100A standard. Certified test data shall be supplied upon request demonstrating compliance with the following parameters:

2. The paint finish shall be capable of passing a 1500 hours Salt Spray test per ASTM B117 and Federal Specification TT-P-141 with no blistering and passing method 6061 with less than 1/16” underfilm corrosion.

3. The paint finish shall be capable of passing an 850-hour Humidity test with 98% relative humidity at 45 to 50°C with no blistering.

4. The paint finish shall be capable of passing a direct impact test per ASTM D-2794 for values greater than 160 in-lbs. and also capable of passing a crosshatch-tape adhesion test.

5. The paint finish shall be capable of passing oil resistance tests of 3 days immersion at room temperature and 3 days immersion at 100°C with no apparent effect. The paint color shall be ASA 70 light gray.

G. Standard Tests

1. The following factory tests shall be made on all transformers. The numbers shown do not necessarily indicate the sequence in which the tests shall be made. All tests shall be made in accordance with the latest revision of ANSI Standard Test Code C57.12.90, where applicable.

   a. Ratio tests on the rated voltage connection and on all tap connections.

   b. Polarity and phase-relation tests on the rated voltage connection.

   c. No-load loss and excitation current at rated voltage on the rated voltage connection.

   d. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of given rating on this project.

   e. Applied potential tests 60 Hz on high and low voltage.

   f. Induced potential tests – 400 Hz.

   g. Mechanical leak and pressure test on tank and coolers.

   h. In addition to the above standard tests, each unit shall be given a Production Line Impulse Test.

2. The following ANSI basic design tests are to be made on a sufficient number of transformers and ratings to demonstrate compliance with these standards. Design tests are not required to be repeated unless the design of the transformer is changed so as to modify the reliability of predicted results.

   a. Audible sound level

   b. Temperature rise.

3. Certified copies of the above Standard tests and test data on basic design shall be furnished upon request by the engineer.

H. High Voltage Compartment

1. The high voltage compartment shall include the following additional equipment:

   a. LBOR Switch

      1) An LBOR (Loadbreak Oil Rotary) switch is to be gang operated and suitable for either radial or loop feed switching as shown on the drawings. The stacked deck rotary switch is to be spring loaded cam-operated kicker system, which provides quick make, and break action to the contacts.

      2) LBOR Ratings:

a) Continuous and Interrupting Current	200A
b) Momentary Current (RMS Sym./Asym.)	10 KA/16 KA

c) Close-in Current (RMS Sym./Asym.) 10 KA/16 KA

d) Maximum Voltage (L-L) 15 KV

e) Corresponding Ratings: BIL 60 KV

2. High Voltage Fusing to be as follows:

a. Provide Bay-O-Net type current limiting fuses externally replaceable with distribution hot stick without opening the transformer tank.

b. Fuses to have continuous current ratings sized per the manufacturer's recommendation for the indicated KVA, impedance and primary voltages.

PART 3 - EXECUTION

3.1 SITE CONDITIONS AND COORDINATION

A. Coordinate with civil and plumbing site record drawings for location of all underground service piping. Adjust routing as required for site electrical runs to avoid any conflict.

B. The general location and arrangement of underground conduits, pull boxes, etc., are shown on the drawings and all installations shall be made in accordance. Information on the drawings relative to existing service is approximate only. Minor deviations required to conform to actual locations shall be made without additional cost to Owner.

C. The Contractor shall, as work progresses, verify the dimensions of the spaces available for the installation of the work and he shall assume full responsibility for the proper locations for each portion thereof.

D. The working drawings are generally diagrammatic and the locations indicated may be approximate only. They do not show every bend, or elbow required for installation. The Contractor, therefore, shall install all equipment, boxes, and conduit runs as required for a complete underground service and distribution system. Adhere to the location indicated as near as possible.

3.2 INSTALLATION

A. General

1. Work and storage areas shall be kept clean and dry. Manholes shall be pumped dry and kept dry from the start of duct preparation until all cables are installed and tested. Cables shall be properly supported at all times so they do not lay on the floor or reach within 12 inches of it.

B. Medium Voltage Vaults

1. Cables shall be racked, in the underground vaults, in a neat and workman like manner. All cables shall be identified by a permanent tag or label. A full radius of cable shall be provided in each vault. Cables shall be fastened to a smooth supporting surface designed for the purpose.

C. Conduit Systems

1. Conduit system shall be installed for all wiring. Conduit shall be run continuous and with the minimum number of bends.

2. Conduit for underground runs shall be RNC. Provide high voltage marker tape 12" above top of conduit in trenches.

3. RNC used for Medium Voltage conduit system shall be provided with concrete encasement of conduit.

4. All conduit shall be delivered to the site of construction in their original bundles. Each length of conduit shall bear the label of the National Board of Fire underwriters. All conduit subjected to rough usage while on the job before installation and not acceptable to the Architect shall be removed from the premises upon notice.

5. The joints in all conduits installed under concrete slabs on the ground, or underground, or exposed to the weather, shall be made liquid and gas-tight. All underground conduit outside of buildings shall be buried to a depth of not less than 30" below finish grade.

6. Changes in direction shall be made with conduit sweep elbows or long radius bends made on the job. Where two or more conduits are grouped in exposed locations, the sweeps shall be struck from the same center forming concentric arcs.

7. All joints in conduits shall be made with standard coupling. In making joints, conduits must be truly and accurately cut and threaded (where applicable) with straight thread, smoothly reamed and squarely butted. All conduit shall be kept corked and dry during construction, using plastic caps or conduit pennies held in place with conduit bushings. Should dirt or moisture collect in any conduit, the Contractor shall swab them out to the satisfaction of the Architect.

8. All empty conduit shall be equipped with nylon pull cord continuous from outlet to outlet.

9. Each primary single duct shall be completely encased in concrete with a minimum of 3 inches of concrete around each duct except that only 2 inches of concrete are required between adjacent electric power ducts. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. At any point tops of concrete encasements shall be not less than 24 inches below finished grade or paving. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not further apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

10. Underground duct banks shall be cleaned prior to pulling cables. Immediately before cables are to be pulled, a well fitted swab shall be pulled through the duct in one direction to wipe all foreign matter and moisture from the duct.

11. A mandrel assembly shall be pulled through the duct without forcing. If the mandrel does not easily pass through the duct, the distance pulled to that point shall be noted and the duct work exposed.

D. Conductor Identification

1. High-voltage cable identification tags shall be provided for all cables in each manhole, vault, tunnel, sectionalizing boxes, and all exposed locations

E. Conductor Installation

1. On receipt, cable protective covering shall be inspected for evidence of damage during shipment.

2. Handling of cables, installing, grounding, splicing and testing shall be accomplished in full compliance with the instructions and recommendations of the cable manufacturer.

3. No wire shall be installed until all work of other contractors that might cause injury to the said wire has been completed. Care shall be used to pull wires to insure that no damage occurs to the insulation. Powdered soapstones or wire ease shall be used for pulling in wires.

4. No splices shall be permitted in primary or 480V feeders, unless approved by Engineer.

3.3 GROUNDING

A. The conduit system, supports, cabinets, switchboards, etc., must be permanently and effectively grounded by means of approved ground clamps, in accordance with Title 24 of the California Code of Regulations.

B. This Contractor shall exercise every precaution to obtain good contacts at the S&C Vista Underground Distribution Switch and medium voltage vault. Utilize a #4/0 AWG bare copper ground wire to ground the tank and enclosure in accordance with the manufacturer's installation instructions. The equipment case and tank shall be grounded to satisfy applicable code and manufacturer requirements.

3.4 CONCRETE PADS

A. Concrete pads shall be constructed as indicated. Tops of concrete pads shall be level and shall project above finished grade and sloped to drain. Conduits for primary and grounding conductors shall be set in place prior to pouring of concrete pads.

B. If any portion of the enclosure gasket does not seal the enclosure to the foundation, provide grout to seal the enclosure as directed by the manufacturer.

C. After equipment has been installed, provide a weatherproof temperature vulcanizing silicon rubber compound caulk around the bottom of the enclosure.

D. Apply a suitable duct seal compound to fill spaces between cable and conduits and cap all empty conduits to prevent the entry of moisture and rodents.

3.5 PRECAST CONCRETE PULL BOXES AND MANHOLES

A. Contractor shall provide a minimum of 3-6" of sand base material suitable to receive the manhole. The base material shall be compacted and graded level at proper elevation to receive the manhole in relation to the conduit grade or ground cover requirements as designated in the plans.

B. Sealants used between the joints of the 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 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 shall have seals to prevent water from entering the raceway.

D. Cables shall be racked, in the underground vaults, in a neat and workman like manner. All cables shall be identified by a permanent tag or label. A full radius of cable shall be provided in each vault. Cables shall be fastened to a smooth supporting surface designed for the purpose.

3.6 GUARANTEE AND TESTS

A. General

1. Equipment of all kinds installed by this Contractor shall be tested 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.

2. Should any piece of apparatus or any material or work fail in 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.

3. The entire installation shall be free from short circuits and improper grounds. Test shall be made in the presence of the Architect, his Engineer or his representative. 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. Ground tests shall meet the requirements of the National Electrical Code. Upon completion of the work, a final inspection of the Architect and other interested authorities shall be conducted. This Contractor shall guarantee to repair or replace at his expense any material or equipment that develops defects or is determined not to be in conformance with the plans and specifications, during a period of one year after work is accepted by the Owner

B. Medium Voltage Cable Testing

1. After installation and before energizing, the high voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds and metallic shields or sheaths of the cable as the other terminal for each test.

2. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The method, voltage, length of time, and other characteristics of the test shall be in accordance with the cable manufacturer's recommendations for the particular type of cable installed, and shall not exceed the recommendations of IEEE No. 404 for cable joints (and IEEE No. 48 for cable terminations) unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing.

3. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. A test report shall be submitted to the Engineer for approval prior to energizing.

C. Testing shall be by an independent testing company that specializes in electrical equipment testing. NETA or NICET certification is required.

END OF SECTION 260301

SECTION 261340
CABLE TRAYS

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. Provide a complete system of cable tray within IT and Server Rooms. The system of cable tray shall include trays, elbows, fittings, offsets, grounding lugs and bonding jumpers, supports and bracing and other tray accessories needed for a complete system.

B. Related Sections

1. Division 26 Section 260000 – Summary of Electrical Work
2. Division 26 Section 260100 – General Conditions for Electrical Work
3. Division 26 Section 260500 – Basic Electrical Materials and Methods
4. Division 26 Section 260526 – Grounding

1.3 CODES AND STANDARDS

A. Cable trays shall conform to the following codes and standards:

1. 2019 California Electrical Code;
2. NEMA VE 1 Metal Cable Tray Systems;
3. NEMA VE 2 Cable Tray Installation Guidelines;

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260100 “General Conditions for Electrical Work”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of cable tray manufactured by Eaton B-Line. Subject to compliance with project requirements, equivalent product by one of the following manufacturers may be considered.

1. Eaton B-Line;
2. Cope
3. Chatsworth Products;
4. PW Industries, Inc;

2.2 LADDER TYPE CABLE RUNWAY

A. Ladder type cable runway shall be a complete system of Chatsworth Products Cable Runway including straight sections, elbows, offsets, grounding lugs and bonding jumpers, connectors, accessories, supports and bracing to form a complete system.

B. Construction: Ladder type cable tray shall be 12-inches wide and have tubular side rails constructed of rectangular steel tube per ASTMA-513 with rungs constructed of rectangular steel bar per ASTMA-36 arc-welded between rails at 9” on center. Ladder type cable trays shall have a 7/16” ground hole drilled at each end of each section and each section shall be bonded with a #1 AWG copper bonding jumper. Ladder type cable trays shall be black in color.

C. Inside radii of elbows shall be 12-inches.

D. Two (2) cable dropouts shall be furnished and installed at the location of each server rack.

E. Accessories and fittings: Manufacturer’s standard clamps, hangers, brackets, splice plates, runway elevation kits, reducer plates, blind ends, barrier strips, connectors, and ground straps.

F. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

2.3 LADDER TYPE CABLE TRAY – SOLID BOTTOM

A. Ladder type cable tray shall be a complete system of B-Line Redi-Rail Series Solid Bottom Cable Tray including straight sections, elbows, offsets, grounding lugs and bonding jumpers, connectors, accessories, supports and bracing to form a complete system.

B. Construction: Ladder cable tray shall consist of two side rails with a solid sheet over runs spaces on 12” centers. Size as indicated on drawings. Straight sections, fitting side rails, rungs, and splice plates shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052. Straight sections shall be supplied in standard 10’ lengths.

C. Accessories and fittings: Manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, splice plates, and ground straps.

D. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

E. Construct units with rounded edges and smooth surface.

F. All fittings must have a minimum radius of 12 inches

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine site conditions for acceptance of cable tray installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Location of cable tray shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor obstruct access to mechanical or electrical equipment. Provide offsets as required to avoid obstruction of cable tray with other trades.

B. Exposed cable trays shall be run parallel or at right angles to the centerlines of columns and beams.

C. Cable trays shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

D. Cable trays shall not be placed closer than 3-inches to any branch circuit power raceway.

3.3 INSTALLATION

A. Install cable tray in accordance with manufacturer's written instructions.

B. Installation shall conform to NEMA VE 2 requirements.

C. Support cable tray at each connection point, at the end of each run and at other points to maintain spacing between supports of 10-feet maximum.

D. Cable tray support shall be a trapeze type hanger system consisting of two (2) 1/2" threaded rods supported from structure above with 1-5/8" x 1-5/8" construction channel span between. Channel shall have 1" slots spaced 2" on center and be mounted with open side down. Mount cable tray on trapeze hanger using hold-down clamps to secure.

E. Provide lateral bracing support along cable tray spaced at a maximum of 30’-0” on center. Bracing shall consist of 3/32” aircraft cable, pre-stretched, with one side of trapeze channel and installed at a 45-degree angle up to the roof diaphragm. Alternate bracing on both sides of cable tray.

F. Provide bonding continuity between all cable tray sections and fittings.

3.4 THRU-WALL PENETRATIONS

A. Where cable tray encounters full height walls, cable tray shall end 6-inches from each side of full height wall and 4-inches conduit sleeves shall be installed to facilitate telecommunication cable pass-thru. Quantity as called for or to allow for full cable tray capacity. Where a full height wall is part of a fire-rated assembly thru-wall fire stopping devices shall be installed in place of conduit sleeves in accordance with UL listing and manufacturer’s written instructions. A bonding jumper shall be installed thru the conduit sleeves and separate sections of cable tray shall be bonded.

END OF SECTION 261340

SECTION 262213
DRY-TYPE TRANSFORMERS (600 V AND LESS)

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. Provide and install dry-type Energy Efficient distribution transformers meeting United States Department of Energy DOE 2016 Energy Efficiency standards, with primary and secondary voltages of 600V and less and capacity ratings 15kVA through 1000kVA.

B. Provide and install dry-type control and signal transformers, with primary and secondary voltages of 600V and less, with capacities up to 1000 VA.

1.3 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 Section “Cast-in-Place Concrete”.

B. Coordinate installation of wall-mounting and structure-hanging supports.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260100 “General Condition for Electrical Work”.

B. Product Data

1. Submit rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

C. Shop Drawings

1. Submit wiring and connection diagrams.

D. Manufacturer Seismic Qualification Certification

1. Submit certification that transformer assembly and components will withstand seismic forces defined in Specification Section 260100, "Seismic Anchorage and Bracing". Include the following:

a. Indicate whether withstand certification is based on actual test of assembled components or on calculation.

b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Submit Dimensioned Outline Drawings of Equipment Unit identifying center of gravity and locating and describing mounting and anchorage provisions.

3. Submit detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Test Reports

1. Submit source quality-control test reports.

2. Submit record of tap adjustments specified in Part 3 of this Section.

F. Operation and Maintenance Data

1. Submit operation and maintenance data for transformers to include in maintenance manuals specified in Division 01 and Specification Section 260100 “General Conditions for Electrical Work”.

1.5 QUALITY ASSURANCE

A. Transformers shall be manufactured and tested in accordance with NEMA ST 20-2014, “Dry-Type Transformers for General Applications”.

B. Transformers and accessories shall be 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. Transformers shall comply with IEEE C 57.12.91-2011, “IEEE Standard Test Code for Dry-Type Distribution and Power Transformers”.

D. Transformers shall comply with UL 1561, “Standard for Dry-Type General Purpose and Power Transformers”.

E. Transformers losses for Energy-Efficient Transformers, rated 15 kVA and larger, shall be tested in accordance with the United States Code of Federal Regulations 10-CFR-431.196 procedures and shall be certified as meeting United States Department of Energy DOE 2016 Energy Efficiency Standards.

1.6 CODES AND STANDARDS

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. Installation shall comply with the following codes and standards:

1. California Code of Regulations (CCR)

a. Title 8, Industrial Relations

b. Title 17, Public Health

c. Title 24, Building Standards

2. 2019 California Building Code.

3. 2019 California Fire Code.

4. 2019 California Electrical Code.

5. 2019 California Energy Code.

6. Local Codes.

7. NEMA ST 20-2014

8. IEEE C 57.12.91-2011

9. UL 1561

10. United States Department of Energy DOE 2016 Energy Efficiency Standards

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

B. Approved manufacturers shall be registered firms in accordance with ISO 9001:2015 SIC 3612 (US); which is the design and manufacture of low voltage dry type power, distribution and specialty transformers.

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Transformer cores shall be constructed from high grade, grain-oriented, non-aging silicon steel with high magnetic permeability and low losses.

C. Transformer coils shall be of continuous wire-wound construction without splices, except for taps and shall be impregnated with non-hygroscopic, thermosetting varnish.

2.3 ENERGY EFFICIENT DISTRIBUTION TRANSFORMERS

A. Ratings

1. All insulating materials are to exceed NEMA ST 20 standards and be rated for 220°C UL component recognized insulation system.

2. Transformers 15kVA and larger shall be 150°C temperature rise above 40°C ambient. Transformers 25kVA and larger shall have a minimum of 4 - 2.5% full capacity primary taps. Exact voltages and taps to be as designated on the plans or the transformer schedule.

3. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

4. Transformers shall have minimum efficiencies per DOE 2016 Energy Efficiency Standards when operated at 35% of full load capacity. Efficiency shall be tested in accordance with the United States Code of Federal Regulations 10-CFR-431.196 procedures.

	Single Phase		Three Phase	
	kVA	Efficiency	kVA	Efficiency
a.	15	97.7%	15	97.89%
b.	25	98.0%	30	98.23%
c.	37.5	98.2%	45	98.40%
d.	50	98.3%	75	98.60%
e.	75	98.5%	112.5	98.74%
f.	100	98.6%	150	98.83%
g.	167	98.7%	225	98.94%
h.	250	98.8%	300	99.02%
i.	333	98.9%	500	99.23%
j.			750	99.28%

B. Construction

1. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish.

2. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.

3. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

4. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.

C. Sound levels shall be warranted by the manufacturer not to exceed the following:

1. 15 to 50KVA - 45dB; 51 to 150kVA - 50dB; 151 to 300kVA - 55dB; 301 to 500kVA - 60dB; 501 to 700kVA - 62dB; 701 to 1000kVA - 64dB; 1001 to 1500kVA - 65dB; 1501 to 2000kVA- 66dB

2.4 CONTROL AND SIGNAL TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

2.6 ACCESSORIES

A. Provide weather shields for all transformers located outdoors.

B. Provide a locking mechanism for each circuit breaker a supplying Class 1 transformer that is lockable in the off position. Provide and install a field applied marking on the transformer indicating the location of the remote mounted transformer primary disconnecting means.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

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

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Specification Section 260100, "Seismic Anchorage and Bracing."

B. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit and 4 inches (100 mm) high.

C. Anchor transformers to concrete bases according to manufacturer's written instructions and seismic codes at Project.

D. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

3.3 CONNECTIONS

A. 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.

B. Ground equipment according to Division 26 Section "Grounding".

3.4 ADJUSTING

A. Refer to Specification Section 269500, Electrical Acceptance Testing, for minimum required transformer testing by Contractor.

END OF SECTION 262213

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, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. 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. 2019 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 Specification Section 260100 “General Conditions for Electrical Work”.

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 260100 “General Conditions for Electrical Work” and Section 269500, “Electrical Acceptance Tests”.

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 Section 017823 “Operation and Maintenance Data” and Section 260100 “General Conditions for Electrical Work”, 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 480 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. The main switchboard and each switchboard containing a main circuit breaker utilized as a building main disconnect shall have a permanently installed user-accessible meter Square D Power Logic Model PM5560 with 10/100BaseTx UTP port, RS-485 Modbus serial master port, Ethernet to serial line gateway, embedded web server, two Ethernet ports with Modbus TCP protocol and two Ethernet ports with BACnet/IP protocol, that is separate and in addition to the utility company meter. The user-accessible meter shall provide all of the following functions:

1. Instantaneous (at the time) kW demand

2. Historical peak kW demand

3. Resettable kWh

4. kWh per rate period

5. Ethernet network connection

D. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

E. 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 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 on shop drawings.

F. Utility Pull and/or Metering compartments shall be fabricated to meet utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard.

G. Bus Transition and Incoming Line Pull Sections shall be matched and aligned with basic switchboard.

H. Provide 1in H X 3in W engraved laminated nameplates for each device. Furnish black letters on a white background for all voltages.

I. 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.

J. Bus Connections shall be bolted with Grade 5 bolts and conical spring washers.

K. 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.

L. 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 fluorescent 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.

2.6 CUSTOMER METERING

A. Electronic digital true RMS sensing metering display for each main switchboard main and each feeder serving a busway.

2.7 POWER AND TRIP HISTORY MONITORING

A. System Description:

1. The customer 1% monitoring shall consist of a electronic Circuit Monitor and System Display, as described in Section 16910-1 - Electric Circuit Monitoring, installed as designated on the project drawings.

2. Provide a Square D PowerLogic Class 3020 CM 2350 circuit monitor with waveform capture provisions to monitor the main disconnect in the switchboard.

2.8 METERING TRANSFORMERS

A. All instrument transformers shall be UL recognized per Classification XODW2.

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 NEC, 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 269500, Electrical Acceptance Testing, 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 262416
PANELBOARDS

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. Furnish and install panelboards as herein specified.

1.3 REFERENCES

A. The panelboards and overcurrent protection devices referenced herein shall be designed and manufactured according to the following appropriate specifications.

1. NFPA 70 – 2019 California Electrical Code (CEC).
2. NEMA PB 1 - Panelboards
3. NEMA PB 1.1 – General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
4. UL 489 - Molded Case Circuit Breakers.
5. UL 67 – Standards for Panelboards.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260100 “General Conditions for Electrical Work”.

B. Shop Drawings

1. Submit Shop Drawings for each panelboard 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 260100, “General Conditions for Electrical Work” and Section 269500, “Electrical Acceptance Tests”.

D. Operation and Maintenance Data

1. Submit operation and maintenance data for panelboards to include in “Operations and Maintenance Instructions” manuals specified in Division 01 and Specification Section 260100, “General Conditions for Electrical Work”, 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 panelboard 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 1.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to panelboard 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 PANELBOARDS - GENERAL

A. Panelboards shall be provided as shown on plans and described herein.

B. Panelboard enclosures shall be a minimum of 20” wide and 5.75” deep unless otherwise shown. Panelboards shall be totally flat with flush keyed locks. Enclosures shall be NEMA 1 for panelboards that are installed indoors and NEMA 3R for panelboards that are installed outdoors. Where more stringent panelboard enclosure requirements are specified on the panel schedules, the requirements specified on the panel schedule shall be provided.

C. Fronts shall be cold rolled sheet steel painted with ANSI 61 gray enamel over a rust inhibitor. They shall be equipped with door, flush hinges, and flush proper cylinder tumbler lock, metal circuit card holder, and quarter turn adjustable trim clamps. Panel locks shall be keyed alike.

D. Panel shall consist of reinforced corrosion resistant galvanized sheet steel frame with silver plated copper bus bars and circuit breakers properly supported to prevent vibration breakage in handling. All terminals shall be solderless type suitable for specified conductors of size indicated.

E. Each panelboards shall have a full size neutral bus. The neutral bus shall be 200% rated when supplied from a double neutral feeder. Each panelboards shall also have a full size equipment ground bus. In addition to the equipment ground bus, provide an isolated ground bus when supplied from a feeder which includes an isolated grounding conductor.

F. Branch circuit breakers shall be molded case, bolt-on, and fully interchangeable without disturbing adjacent units. All 2-pole and 3-pole breakers shall have common trips. Circuit breakers supplying Class 1 transformers shall be lockable in the off position.

G. Branch panelboards and overcurrent protection devices shall have a minimum short circuit rating of 22,000 RMS symmetrical AIC (120/208V).

H. Distribution panelboards and overcurrent protection devices shall have a minimum short circuit rating of 42,000 RMS symmetrical AIC (120/208V).

I. All Panelboards shall be fully rated as shown on Drawings; series-rating shall not be allowed.

J. Panelboards shall bear an Arc-Flash Hazard Warning label in accordance with CEC Article 110.16.

K. Breakers for switching lights shall be type SWD, rated for switching duty. Breakers for mechanical equipment shall be HACR type.

L. All spaces shall have at minimum filler plates installed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive panelboards to provide adequate clearance for panelboard installation.

B. Check that working space is level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Panelboards shall have, in addition to conduit shown on the drawings, two ¾" and three 1" conduits stubbed to nearest accessible attic space.

B. Panelboards shall be installed with the top of the trim at 6'-0" above the finished floor, unless otherwise indicated on the drawings.

C. Where space permits, panelboards shall be surface mounted where they are not visible to the public.

D. Panelboards shall have a typewritten circuit directory installed mounted behind plastic in a metal holder that is welded to the inside of each panel door. The type written circuit directory shall show circuit numbers and complete description of all outlets on each circuit and

E. An Arc-Flash Hazard Warning label shall be applied to each panelboard in accordance with CEC 110.16.

F. Labeling of all circuits at panelboards shall match the exact room names of each of the spaces. Verify exact room names with Owner prior to labeling.

G. Electrical loads shall be disaggregated into separate panelboards per the 2019 California Energy Code Section 130.5(b).

3.3 CONNECTIONS

A. Connect panelboards 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 269500, Electrical Acceptance Testing, 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 any 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 262416

SECTION 265113
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, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. The Contractor shall provide, install, connect, commission, test and place into operation a complete lighting system in accordance with the requirements of 2019 California Energy Code, California Code of Regulations Title 24, Part 6, and as herein specified.

2. Basis of Design for lighting system: Lighting systems are primarily based on the use of dimmable LED fixtures as specified herein.

3. 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, 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, and connect and disconnect LED modules 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 ceiling 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 Sections to avoid conflicts between luminaries, supports, fittings, and mechanical equipment.

D. All fixtures shall be coordinated with the architectural reflected ceiling plan. If any discrepancies occur, the Architect or Electrical Engineer must be notified in writing before installation is started.

1.6 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260100 “General Conditions for Electrical Work”.

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 LED modules, LED drivers, 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 “General Conditions for Electrical Work”.

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 2019 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 260100, except where noted otherwise.

B. Provide fixtures complete with all fittings, LED modules, drivers, 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. Lenses shall be virgin acrylic, 0.125 inches thick minimum, unless otherwise noted.

F. There shall be no visible trademarks or monograms on the lighting fixtures.

G. The Contractor shall provide lay-in frames for all exposed suspended grid ceiling systems and flanged trims for plasterboard, spline or metal lathe and plaster ceiling systems. The Contractor shall provide plaster or mounting frames where required.

H. 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.

I. 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

J. Fixtures installed in non-hazardous locations shall conform to UL 1598.

K. Light emitting diode (LED) equipment used in fixtures shall conform to UL 8750.

L. Exposed hardware shall be stainless steel.

2.2 LED FIXTURES

A. LED Modules

1. Color Temperature: 4,000 Kelvin (K)
2. Color Consistency: 2-step MacAdams ellipse
3. Color Rendering:
   a. Indoor Fixtures: 90 CRI, or greater
   b. Outdoor Fixtures: 70 CRI, or greater
4. Dimming: LED modules shall be compatible with the 0-10VDC dimmable LED driver.
5. Light Distribution: As indicated on Lighting Fixture Schedule
6. 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 0-10VDC dimmable and shall be compatible with the LED modules and provide the correct 0-10VDC control voltage.
2. LED Drivers shall be independently tested by Intertek and shall bear the ETL Listed Mark as proof of meeting the applicable published safety standards.
3. 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.
4. 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.
5. LED Drivers shall comply with IEC standard 60929, Annex E and shall source no more than 2mA of control current at 0-10VDC.
6. LED Drivers shall be solid-state, electronic, high power factor (minimum 0.9).
7. LED Drivers shall have a Class A sound rating.
8. LED Drivers shall have internal thermal protection to limit driver case temperature to a maximum of 75-degrees C.
9. Ambient Operating Temperature Range: -40-degrees C to 55-degrees C.
10. Rated Frequency: 60-Hertz
11. 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 EXIT SIGNS

A. Exit signs shall conform to UL 924.

B. Sign Colors and Minimum Letter Height shall be per local code.

C. Exit signs shall include arrows as indicated.

D. Exit signs shall have an integral emergency battery pack and shall include an integral automatic charger in a self-contained power pack. Battery shall be sealed, maintenance-free, nickel-cadmium type with special warranty. Charger shall be fully automatic, solid-state type with sealed transfer relay.

E. Lamps for AC operation shall be light emitting diodes with 20,000 hours minimum rated lamp life.

F. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.5 EMERGENCY LIGHTING UNITS

A. Emergency Lighting Units shall conform to UL 924.

B. Emergency Lighting Units shall be self-contained with sealed, maintenance-free, lead-acid type battery with minimum 10-year nominal life and special warranty. Charger shall be minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.

C. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent on nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.

D. Where indicated, provide heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.

E. Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit ON for fixed interval after restoration of power after an outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.

2.6 EMERGENCY LED DRIVERS

A. Emergency LED Drivers shall conform to UL 924

B. Emergency LED Drivers shall be self-contained, modular, battery-inverter unit factory mounted within fixture body. Battery shall be sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life. Charger shall be fully automatic, solid-state, constant-current type.

C. Emergency LED Drivers shall be provided with test switch and LED indicator light visible and accessible without opening fixture or entering ceiling space.

D. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Relay disconnects lamp and battery and automatically recharges when normal voltage is restored.

2.7 EMERGENCY LIGHTING INVERTERS

A. Emergency Lighting Inverters shall be listed to UL 1778 and UL 924 by ETL.

B. Emergency Lighting Inverters shall be compact central lighting inverters self-contained in a single cabinet with the following ratings:

1. Available sizes: 500-, 750-, 1000-, 1250-, 1500-, and 2100-watts; provide sizes as scheduled on the Drawings.
2. Input Voltage: 277-volt
3. Output Voltage: 277-volt
4. Output Frequency: 60-Hz
5. Output Voltage Regulation: 4%
6. Output Waveform: Sinusoidal during emergency with no greater than 10% total harmonic distortion.
7. Output protection: Current limiting and short circuit protection.
8. Battery: Maintenance free sealed lead calcium.
9. Recharge Time: Recharge time shall comply with UL 924.
10. Dimensions: 23.5”W x 34.25”H x 18.25”D
11. Weight: Weight shall not exceed 570-lbs.

C. Emergency Lighting Inverters shall be rated for the following applications: HID, LED, Incandescent, Fluorescent and High Pressure Sodium.

D. Emergency Power inverter shall have the following features:

1. Low profile compact cabinet
2. Single-phase, full range voltage regulation
3. Input circuit breaker
4. Output circuit breaker
5. Battery circuit breaker
6. Monitoring panel: Front panel LCD display unit status; alarm indicators

E. Emergency Lighting Inverters shall be Crucial Power EconoSine 2, sized as scheduled on the Drawings.

2.8 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.

2.9 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. Continuous runs of fixtures shall be installed straight and true.

B. All new fixtures shall be securely anchored to prevent any possible chance of their falling.

C. The Contractor shall coordinate outlets with Acoustic Tile Contractor and other trades and locate outlets in center or at intersections of acoustical tile in all acoustical tile ceilings. All fixtures must be kept 1 ½” clear of all acoustic tile and any combustible material by use of approved spacers, unless Fire Underwriters approved to be surface mounted.

D. All fixtures mounted in or on suspended ceilings shall be fastened to the ceiling framing members in accordance with CEC 410.36(B).

E. Recessed fixtures shall be complete with plaster frames, supporting brackets and hanger wires.

F. When lighting fixtures are equipped with integral emergency battery packs the fixtures shall be wired so that all lamps switch on and off via the room light switch and the emergency lamps are automatically energized if the normal power has failed.

G. Install equipment level and plumb and according to manufacturer's written instructions.

H. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounted devices.

I. Fixture installation shall conform to all applicable standards for installation, mounting, wiring, and quality.

J. All fixtures shall be grounded and bonded in accordance with applicable codes. Where fixtures are installed in rows, a bonding screw shall be used to maintain bonding integrity from fixture to fixture.

K. All fixtures, lenses, and other trim shall be aligned, cleaned, free of paint and blemishes before final acceptance.

L. Fixtures weighing more than 50 pounds shall be supported independent of the fixture box. All outlet boxes shall be able to support a minimum of eight pounds.

M. For fixtures weighting more than two pounds, support shall be provided at all four corners, plus the outlet box. Each support shall be able to carry a minimum of four times its intended load.

N. No support or insert, except pendant canopies, shall be visible from the floor.

O. Where fixtures are pendant suspended, the use of ball aligner and canopies at ceiling and fixture, stem, and other required mounting devices shall be required for installation as required to meet Title 24 requirements. A safety cable anchored to the roof structure shall be installed in all pendants. If any obstruction within the 45 degree swing of the fixture exists, the Contractor shall provide a State approved restraint system to prevent the fixture from swinging into the obstruction.

P. When fixtures are stem mounted, the variation in distance from the finished floor shall vary no more than ½" from the heights as specified on the plans.

Q. Pendant-Mounted fixtures mounting heights shall be to the bottom of the fixture. Mounting heights of the wall-mounted fixtures shall be to the center of the outlet box unless otherwise noted.

R. Provide surface-mounted fixtures with UL approval for direct mounting on the various ceilings, unless specified otherwise. Spacers will not be approved.

S. All fixtures shall be supported directly to building structural members or from bridging attached to the structural members, or shall have positive attached structural angles, and/or all-thread rod extensions from structure to ceiling plane. Fixtures and supports shall be laterally braced independently from suspended ceilings (hard or T-bar) utilizing structural angles at approximate 45° angles in two planes from ceiling plane to structure above. Minimum rod size shall be ½" and minimum angle size shall be ¾" x ¾" x 3/16" unless noted otherwise in specific details. Provide all necessary blocking and hardware so that fixtures hang true, square, plumb, and in proper alignment.

T. Recessed fixtures in suspended grid ceilings (CCR Title 24, part 2, Section 1616A.1.20)

1. All light fixtures shall be attached positively to the ceiling suspension systems by mechanical means per CEC Article 410.36 to resist a horizontal force equal to the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture, per ASTM E580, Section 5.3.1.

2. Light fixtures weighing less than or equal to 10 lbs shall have a minimum of one #12 gage slack safety wire connected from the fixture housing to the structure above.

3. Light fixtures weighing greater than 10 lbs but less than or equal to 56 lbs may be supported directly on the ceiling runners, but they shall have a minimum of two #12 gage slack safety wires connected from the fixture housing at diagonal corners and anchored to the structure above.

4. Light fixture weighing greater than 56 lbs shall be independently supported by not less than four taut #12 gage wires attached to the housing and to the structure above. The four taut #12 gage wires, including their attachment to structure above, must be capable of supporting four times the weight of the unit.

U. Surface fixtures mounted to suspended grid ceilings shall be bolted through ceiling panel to metal channel struts suspended between ceiling <u>main</u> runners. Install hanger wires per above from struts to ceiling.

V. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

W. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

X. Installation of Recessed Lighting Fixtures in Accessible-type Suspended Ceilings shall be such that the fixtures will exactly suit the type of ceilings used without altering the fixture or the ceiling. Each fixture shall be wired with a piece of flexible conduit sufficiently long to remove fixture enclosure from ceiling without disconnecting unit. Fixture manufacturer shall prepare drawing or catalog sheets in which all details of fixture installation are carefully analyzed. Contractor to submit these shop drawings for approval. If clearance above suspended grid system is too restricted to "tip-in" fixture, the Electrical Contractor shall coordinate with acoustic ceiling installer by leaving one cross runner off until the fixture is installed and then the cross runner shall be secured into its proper place.

Y. Where fixtures are installed in 1-Hour Rated Ceiling, Contractor shall provide gypboard "tents" above the fixtures to maintain the integrity of the 1-hour fire ceiling.

Z. Adjust aimable fixtures to provide required light intensities.

3.2 FIELD QUALITY CONTROL

A. Refer to Specification Section 269500, Electrical Acceptance Testing, for minimum required lighting testing by Contractor.

END OF SECTION 265113

SECTION 266100
LIGHTING CONTROL 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. The Contractor shall provide, install, connect, commission, test and place into operation a complete system of lighting control equipment in accordance with the requirements of 2019 California Energy Code, California Code of Regulations Title 24, Part 6, and as herein specified.

2. Basis of Design for lighting control systems: Lighting control systems are primarily based on the use of a distributed digital lighting management system for control of indoor lighting systems and astronomic time clock controls for outdoor lighting systems and sign lighting.

3. Provide lighting control equipment as indicated by drawings and schedules, including but not limited to, digital lighting management system dimming equipment, occupancy sensors, daylight sensors (photosensors), astronomic time clocks and multi-pole lighting relays and contactors and wiring.

4. Mandatory Indoor Lighting Controls:

   a. Area Controls – Provide area controls in each space to facilitate the manual control of lighting within that space.

   b. Multi-level controls – Provide multi-level controls to facilitate the uniform reduction of lighting energy used in each space. Multi-level controls shall be accomplished through dimming.

   c. Automatic Shutoff Controls – Provide occupancy sensors in each space to automatically shut-OFF the lighting when the space is unoccupied.

   d. Automatic Daylighting Controls – Provide daylight sensors in each daylit area and automatically control lighting fixtures within the daylit areas separately from the fixtures located in non-daylit areas.

   e. Demand Responsive Controls – Provide controls that are capable of receiving and automatically responding to a demand response signal.

5. Mandatory Outdoor Lighting Controls:

   a. Outdoor incandescent lighting – Provide a motion sensor at each outdoor incandescent luminaire that is rated over 100-watts.

   b. Controls for outdoor lighting – Outdoor lighting shall be controlled by an astronomic time-switch that automatically turns OFF the outdoor lighting when daylight is available.

c. Motion Sensor Controls – Provide a motion sensor control at each outdoor lighting fixture that is located 24-feet or less above the ground; except lighting fixtures rated 40-watts or less.

6. Provide and install lighting control systems and equipment as indicated on drawings and schedules, including but not limited to, network lighting control system, network ceiling mounted occupancy sensors, network dimming manual control stations, network daylighting sensors (photosensors), network dimming control relays, network plug load control relays, network bridges, network gateways, network automated demand response control interface, network lighting control system integration for nLight enabled lighting fixtures, configuration tools, programming, configuration and documentation software, wall switches with integral occupancy sensors, emergency lighting control devices, astronomic time-switch controls and lighting control panels, photoelectric relays, and multi-pole lighting relays and contactors.

1.3 COORDINATION

A. Confirm compatibility and interface of lighting control equipment with lighting fixtures, LED drivers and ceiling systems. Report discrepancies to the Architect or Electrical Engineer, and defer ordering until clarified.

B. Coordinate with Division 21-25 to avoid conflicts between supports, fittings, and mechanical equipment.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260100 “General Conditions for Electrical Work”.

B. Shop Drawings:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.

2. Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans.

3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.

4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicates where sensor is proposed to be installed.

2. Prove that the sensor is suitable for the proposed application.

1.5 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. All lighting control devices and systems shall be certified by the manufacturer as meeting the requirements of the current California Code of Regulations Title 20, Appliance Efficiency Regulations.

2. All work, commissioning and testing shall fully comply with the 2019 California Energy Code.

1.6 CODES AND STANDARDS

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. Installation shall comply with the following codes and standards:

1. California Code of Regulations (CCR)
   a. Title 8, Industrial Relations
   b. Title 17, Public Health
   c. Title 24, Building Standards
2. 2019 California Building Code.
3. 2019 California Fire Code.
4. 2019 California Electrical Code.
5. 2019 California Energy Code.
6. Local Codes.
7. ANSI/TIA/EIA-568-C-2012 Commercial Building Telecommunications Standard
8. ANSI/TIA/EIA-607-B-2013 Grounding and Bonding Requirements for Telecommunications in Commercial Buildings
9. BICSI TDMM Telecommunications Distribution Methods Manual 12th Edition
10. NEMA VE1 Cable Tray Systems
11. NEMA VE2 Cable Tray Installation Guides
12. UL 467 Grounding and Bonding Equipment.
13. UL 1479 Fire Tests of Through-Penetration Firestops

1.7 WARRANTY

A. The 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. Provide five-year manufacturer's warranty on all digital lighting management system room control devices and panels.

1.8 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.

2. Review the specifications for low voltage control wiring and termination.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

4. Discuss requirements for integration with other trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of nLight network lighting controls equipment manufactured by Acuity Brands nLight. Subject to compliance with project and specification requirements, equivalent products by the following manufacturers may be considered if a complete substitution request including shop drawings is submitted and approved prior to bid.

1. Network Lighting Controls nLight

2. Cooper Greengate;

3. WattStopper;

B. System: Network Lighting Controls nLight

2.2 NETWORK CEILING MOUNTED OCCUPANCY SENSOR

A. Network ceiling mounted occupancy sensors shall be dual technology digital passive infrared and microphonic occupancy sensors.

B. Network ceiling mounted occupancy sensors shall include the following features:

1. Communicates with the nLight network;

2. Low voltage auxiliary relay rated 1-amp at 24VAC/VDC with 2#20 AWG wire leads;

3. RJ45 port, RJ45 splitter and Category 5e patch cable;

4. Physical Description: Size: 4.55” diameter, 1.55” deep; Weight: 6oz; Color: Matte White;

5. Mounting: Ceiling Tile / Gypsum board surface, or 3.5” octagonal box, or single-gang handy box;

C. Network ceiling mounted occupancy sensors shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight product numbers: nCM PDT 9 RJB AR (in offices and spaces less than 250-square-feet); nCM PDT 10 RJB AR (in corridors and spaces greater than 250-square-feet); nCM PDT 6 RJB AR (only in spaces with ceiling height greater that 15-feet);

2.3 SINGLE-ZONE NETWORK MANUAL CONTROL STATIONS

A. Single-zone network dimming manual control stations shall include the following features:

1. Communicates with the nLight network;

2. Two RJ45 ports;

3. Physical Description: Size: 2.74” high, 1.68” wide, 1.63” deep; Weight: 2oz; Color: Matte White;

4. Two buttons: “ON” and “OFF”

5. Mounting: Single-gang, 2-3/4” deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

C. nLight product number: nPODM; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.4 SINGLE-ZONE NETWORK DIMMING MANUAL CONTROL STATIONS

A. Single-zone network dimming manual control stations shall include the following features:

1. Communicates with the nLight network;

2. Two RJ45 ports;

3. Physical Description: Size: 2.74” high, 1.68” wide, 1.63” deep; Weight: 2oz; Color: Matte White;

4. Three buttons: “ON/OFF”; up arrow; and down arrow

5. Mounting: Single-gang, 2-3/4" deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

C. nLight product number: nPODM DX; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.5 FOUR-SCENE NETWORK DIMMING MANUAL CONTROL STATIONS

A. Four-scene network dimming manual control stations shall include the following features:

1. Communicates with the nLight network;
2. Two RJ45 ports;
3. Physical Description: Size: 2.74" high, 1.68" wide, 1.63" deep; Weight: 2oz; Color: Matte White;
4. Eight buttons custom engraved: "ON"; "OFF"; "ENERGY"; "A/V"; "DIM-50%"; "DIM-5%"; up arrow; and down arrow
5. Mounting: Single-gang, 2-3/4" deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

C. nLight product number: nPODM 4S DX; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.6 TOUCH SCREEN RGB SHOW CONTROLLER

A. Wall mounted DMX 512 show controller with touch screen LCD screen with the following features.:

1. Communicates via DMX 512;
2. Includes FCS PS10 power supply;
3. Two RJ45 ports;
4. Physical Description: Size: 2.74" high, 1.68" wide, 1.63" deep; Weight: 2oz; Color: Matte White;
5. Touch screen which allows show creation and playback,;

6. Mounting: Single-gang, 2-3/4" deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Device must be capable of utilizing pre programmed shows (chase feature) have onscreen color selects with favorites storing and recalling, have on-screen master intensity slider and on-screen master speed slider, and shall allow for editing of all shows through the LCD interface.

C. Acuity Easyl product number: EZSOLO-MVOLT; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.7 DIGITAL KEYED SWITCH MANUAL CONTROL STATIONS

A. Digital keyed switch manual control stations shall include the following features:

1. Communicates with the nLight network;
2. Two RJ45 ports;
3. Physical Description: Size: 4" high, 1.3" wide, 1.63" deep; Weight: 2oz; Color: Matte White;
4. Key action: Return-to-center for momentary.
5. Pilot LED's to indicate on or off status.
6. Mounting: Single-gang, 2-3/4" deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Digital keyed switch manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

C. nLight product number: nPOD KEY; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.8 NETWORK DAYLIGHTING SENSORS

A. Network daylighting sensors shall be closed loop photosensors that measure the ambient light in the space and provide automatic dimming daylight harvesting capabilities for any load type connected to the network. Daylighting sensors shall be interchangeable without the need for rewiring.

B. Network daylighting sensors shall include the following features:

1. Communicates with the nLight network;
2. RJ45 port, RJ45 splitter and Category 5e patch cable;
3. LED indicator;

4. Physical Description: Size: 4.55” diameter, 1.55” deep; Weight: 6oz; Color: Matte White;

5. Mounting: Ceiling Tile / Gypsum board surface, or 3.5” octagonal box, or single-gang handy box;

C. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight Product Number: nCM ADCX RJB.

2.9 NETWORK DIMMING CONTROL RELAYS

A. Network dimming control relays shall automatically bind the room loads to the connected devices in the space. The quantity of network dimming control relays shall be provided to match the number of control zones required in each space.

B. Network dimming control relays shall be the On/Off/Dimming type and include the following features:

1. Communicates with the nLight network;

2. One 120/240/277VAC, 16-amp, latching lighting relay;

3. Sinks 100mA; 0-10VDC dimmable LED drivers;

4. Two RJ45 ports;

5. LED indicator;

6. Physical Description: Size: 3.38” high x 2.53” wide x 1.83” deep + ½” chase nipple; Weight: 6oz; Color: White;

7. Mounting: Mount to a 5S x 2.5” deep large capacity outlet box;

C. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight Product Number: nPP16 (D).

2.10 NETWORK PLUG LOAD CONTROL RELAYS

A. Network plug load control relays shall automatically bind a rooms controlled receptacles loads to the network occupancy sensor in the space.

B. Network plug load control relays shall include the following features:

1. Communicates with the nLight network;

2. One 120-volt, 20-amp, UL general purpose latching relay

3. Two RJ45 ports;

4. LED indicator;

5. Physical Description: Size: 3.38” high x 2.53” wide x 1.83” deep + ½” chase nipple; Weight: 6oz; Color: Blue;

6. Mounting: Mount to a 5S x 2.5” deep large capacity outlet box;

C. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight Product Number: nPP20 PL

2.11 NETWORK BRIDGE

A. The network bridge shall be a linear topology subnet to connect nLight network for centralized control.

B. Network bridge shall include the following features:

1. Communicates with the nLight network;

2. Eight RJ-45 network ports; two Class 2 power supply input terminals;

3. Remotely configurable and upgradeable;

4. Push-button programmable;

5. Green LED indicators for each port;

6. Distributes bus power between ports;

7. Supports up to 128 nLight devices per port;

8. Bridge port identification stickers and commissioning card;

9. Physical Description: Size: 4.90” high x 4.90” wide x 1.05” deep; Color: White;

10. Mounting: Mount to a 4S x 2.125” deep outlet box;

C. Provide and install one PS 150, 150mA, 120/277V power supply at each network bridge mounted to 4S outlet box with the network bridge.

D. nLight Product Number: nBRG 8 KIT

2.12 NETWORK GATEWAY

A. The network gateway shall be a linear topology subnet to connect nLight network bridges for centralized control and shall have a touch screen control user interface.

B. Network gateway shall include the following features:

1. Communicates with the nLight network;

2. Two RJ-45 nLight bus ports; one touch screen interface power network port; one Ethernet port; two Class 2 power supply input terminals;

3. Remotely configurable and upgradeable;

4. Push-button programmable;

5. Green LED indicators for each port;

6. Supports up to 128 nLight devices per port;

7. Bridge port identification stickers and commissioning card;

8. Physical Description: Size: 4.90” high x 4.90” wide x 1.05” deep; Color: White;

9. Mounting: Mount to a 4S x 2.125” deep outlet box;

10. One LCD touch screen user interface;

C. Provide and install one FCS PS 10, 10W, 120/277V power supply at each network gateway mounted to 4S outlet box with the network gateway.

D. nLight Product Number: nGWY2 KIT

2.13 NETWORK AUTOMATED DEMAND RESPONSIVE CONTROL INTERFACE

A. Provide and install a network automated demand responsive control interface. The network automated demand responsive control interface shall receive and automatically respond to OpenADR 2.0a messaging protocol and shall respond by adjusting the peak lighting power demand to 85-percent of maximum lighting power demand.

B. Network automated demand responsive control interface shall include the following features:

1. Communicates with the nLight network;

2. One micro USB power connector; one 10/100 BaseT Ethernet;

3. Physical Description: Size: 1.06” high x 2.76” wide x 3.94” deep; Color: White;

4. Mounting: Wall mount;

C. Provide and install one power supply cord at network automated demand responsive control interface;

D. nLight Product Number: nADR

2.14 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. Programming shall be provided by the Contractor through a web-based suite of applications that gives the programmer the ability to remotely configure and monitor nLight network luminaires and nLight control devices.

B. The Contractor shall completely program and configure the lighting control system to comply with 2019 California Energy Code requirements.

C. Provide one nCOMKIT and commissioning tool interface;

D. Communication Protocol: Programming software shall communicate with nGWY2 over LAN IP network and with nLight network directly through nCOMKIT and commissioning tool interface and shall be able to program up to 20,000 network controlled devices.

E. System Requirements: Laptop or PC with Windows 7 or newer operating system; 4GB RAM and 2GB minimum available memory; Internet Explorer 10 and newer, Chrome, or Firefox browsers.

F. Acuity Controls Product Number: SensorView 13, nCOMKIT

2.15 WALL SWITCH WITH INTEGRAL OCCUPANCY SENSOR

A. Wall switches with integral occupancy sensors shall be comprised of an all digital, passive infrared technology (PIR) sensor to detect human presence.

B. System shall have field selectable auto-ON or manual-ON operating modes and shall be factory set to the manual-ON operating mode.

C. Wall switches with integral occupancy sensors shall be rated: 120/277-volt; 60Hz and shall have separate neutral and equipment grounding connection wire leads.

D. Wall switches with integral occupancy sensing shall be Sensor Switch model WSX (in Janitors closets and storage rooms having only one lighting fixture).

2.16 CONTACTORS AND AUXILIARY RELAYS

A. Contactors and relays shall comply with NEMA ICS 2.

B. Devices are electrically operated and mechanically held. Number of poles and ratings are as indicated. Coordinate rating of each unit with type of load served, including tungsten filament and inductive-type loads.

C. Modular Single-Pole Relays shall be split-coil, momentary-pulsed type, knockout mounting.

1. Low-Voltage Leads: 5-pin plug connector.

2. Pilot Contacts: Single pole.

3. Rated Capacity: 20A, 125VAC for 120-volt lighting loads, and 20A, 277VAC for 277-volt lighting loads.

4. Endurance: 50,000 cycles at rated capacity.

2.17 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a circuit providing normal lighting to an area. The unit provides normal dimming and ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp dimming LED driver rating

2. Push to test button

3. Auxiliary contact for remote test or fire alarm system interface

B. nLight Product Numbers: nPP16 ER SHUNT.

2.18 NLIGHT ENABLED NETWORK LIGHTING FIXTURES

A. Lighting fixtures specified as nLight enabled shall have an integral nLight network interface and be integrated into the nLight network lighting control system.

2.19 LIGHTING CONTROL PANEL

A. The lighting control panels shall be the nLight network connected 12-relay cabinet including the following features:

1. Communicates with the nLight network;
2. Eight 20-amp relays rated for 277-volts; able to separately switch up to twelve 120/277 VAC loads.
3. Twelve 0-10VDC dimming outputs
4. Two RJ45 ports
5. Integrated power supply for nLight bus and auxiliary device power;
6. Heavy duty terminal blocks;
7. Push button programming;
8. NEMA 1 Enclosure;
9. Physical Description: Size: 23.65” high x 15.65” wide x 4.06” deep; Weight: 12lbs. Color: White;
10. Mounting: Wall mount;

B. nLight Product Numbers: nLight Relay Panel model ARP INTENC08 NLT 8FCR MVOLT 1VB HLK SM

PART 3 - EXECUTION

3.1 INSTALLATION, CALIBRATION AND PROGRAMMING SERVICES

A. Install all devices and wiring in a professional manner. All line voltage connections shall be tagged to indicate circuit and switched legs.

B. Category 5e network cables shall not have boots installed at the RJ45 plug connectors.

C. Provide and install category 5e cable with RJ-45 connectors interconnecting all control device, bridges and gateways. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturer with test results. Low voltage wiring topology must comply with manufacturer’s specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

D. Provide and install one ¾" conduit with 2#12 copper THWN/THHN + 1#12 copper ground between nearest constant hot portion of lighting branch circuit and each PS 150 power supply. Connect line voltage to each power supply and connect the Class 2 low voltage wiring between the PS 150 power supply and network bridge.

E. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, the contractor shall test all devices to ensure proper communication.

F. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

G. Adjust time delay so that controlled area remains lighted while occupied.

H. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters (e.g. blink warning, etc.)

I. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

J. Network daylight sensors for automatic dimming within a daylit zone shall be calibrated such that lighting power for the lighting fixtures within that daylit zone shall be reduced by 65% when daylit illuminance is 150% of design illuminance. Design illuminance for specific spaces shall be as recommended by the IESNA Lighting Handbook 8th Edition Chapter 11, Figure 11-1, for Commercial, Institutional, Residential, and Public Assembly Interiors.

K. Program uniform manual dimming and ON-OFF control within each space that has a network daylight sensor:

1. Lighting fixtures located within daylit zones shall be programmed to manually turn ON and OFF with lighting fixtures located outside of the daylit zones (in the same space) with a common ON/OFF button.

2. Lighting fixtures located within daylit zones shall be programmed to manually dim at the same rate as lighting fixtures outside of the daylit zone (in the same space) once lighting fixtures outside of the daylit zone have had lighting power manually reduced by 65%.

L. Program four-scene network dimming manual control stations as follows:

1. ENERGY (Scene 1): Selection of the "ENERGY" scene shall uniformly lower the lighting levels of all lighting fixtures within the space to 85-percent of their maximum lighting power demand.

2. A/V (Scene 2): Selection of the "A/V" scene shall turn OFF all lighting fixtures the first row located in front of a projection screen or video monitor and shall reduce all other zones within the space to 20-percent of maximum light output.

3. DIM-50% (Scene 3): Selection of the “DIM-50%” scene shall uniformly lower the lighting levels of all lighting fixtures within the space to 50-percent of maximum light output.

4. DIM-5% (Scene 4): Selection of the “DIM-5%” scene shall uniformly lower the lighting levels of all lighting fixtures within the space to 5-percent of maximum light output.

M. Lighting controls shall be connected and programmed to be demand responsive and shall automatically reduce building lighting power demand by 15% in response to a demand response signal per 2019 CA Energy Code section 130.1 (e).

3.2 FACTORY SERVICES

A. Upon completion of the installation, a manufacturer's factory authorized representative shall start up and verify a complete and fully functional system.

B. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.3 ACCEPTANCE TESTING AND COMMISSIONING

A. The Contractor shall provide the services of a California State certified lighting controls acceptance test technician (CLCATT) to act as the acceptance testing agent and verify the installation of the lighting control systems.

B. Provide the services of a manufacturer’s factory technician time to assist the CLCATT review the functionality and settings of the lighting control hardware per the requirements in the California State forms.

C. The Contractor shall provide the services of a Commissioning Agent to provide commissioning of the indoor and outdoor lighting systems. The following commission tasks shall be completed in accordance with 2019 California Energy Code, Section 120.8 Building Commissioning:

1. The Commissioning Agent shall obtain the Owner’s Project Requirements.

2. The Commissioning Agent shall compile and update a Basis of Design during the construction of the project.

3. The Commissioning Agent shall complete a commissioning plan including the following information:

a. General project information

b. Commissioning goals

c. Systems to be commissioned

d. Plans to test systems and components, which shall include:

1) An explanation of the original design intent

2) Equipment and systems to be tested, including the extent of the tests

3) Functions to be tested

4) Conditions under which the test shall be performed
5) Measurable criteria for acceptable performance
6) Commissioning team information
7) Commission process activities, schedules and responsibilities

4. The Commissioning Agent shall provide function performance testing.
5. The Commissioning Agent shall provide system documentation and training requirements.
6. The Commissioning Agent shall provide a commissioning report.

3.4 TITLE 24 - PART 6 DOCUMENTATION OF INSTALLATION AND ACCEPTANCE FOR INDOOR AND OUTDOOR LIGHTING

A. The Contractor shall prepare and submit the following Certificates of Installation:

1. Indoor Lighting:
   a. Certificate of Installation – Validation of Certificate of Compliance (NRCI-LTI-01-E)
   b. Certificate of Installation – Energy Management Control System or Lighting Control System (NRCI-LTI-02-E)
   c. Certificate of Installation – Power Adjustment Factors (NRCI-LTI-05-E)
2. Outdoor Lighting:
   a. Certificate of Installation – Outdoor Lighting (NRCI-LTO-01-E)
   b. Certificate of Installation – EMCS – Lighting Control System (NRCI-LTO-02-E)
3. Sign Lighting:
   a. Certificate of Installation – Sign Lighting (NRCI-LTS-01-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 2019 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. Indoor Lighting:
   a. Certificate of Acceptance – Lighting Controls (NRCA-LTI-02-A)
   b. Certificate of Acceptance – Automatic Daylighting (NRCA-LTI-03-A)
   c. Certificate of Acceptance – Demand Responsive Lighting Controls (NRCA-LTI-04-A)
2. 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 2019 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. Indoor Lighting:
   a. 13.88 NA7.6.1 Automatic Daylighting Control Acceptance
   b. 13.89 NA7.6.2.4 and NA7.6.2.5 Automatic Time Switch Acceptance
   c. 13.90 NA7.6.2.2 and 7.6.2.3 Occupant Sensor Acceptance
   d. 13.91 NA 7.6.3 Demand Responsive Controls Acceptance
2. Outdoor Lighting
   a. 13.92 (NA7.8) Outdoor Lighting Shut-off Controls

3.5 ON-SITE ASSISTANCE

A. Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust light levels, make program changes, and adjust sensors and controls to suit actual conditions.

3.6 PERSONNEL TRAINING

A. Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 266100

SECTION 269500
ELECTRICAL ACCEPTANCE TESTS

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. This Section defines the 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.

2. 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. 2019 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. Medium Voltage (Primary) Cable

C. Secondary Switchgear

D. Switchboard

E. Molded Case Circuit Breakers Rated Less Than 100A

F. Power Cable

G. Distribution Transformers

H. Distribution Equipment

I. Disconnect Switches

J. Motors

K. Lighting

L. Title 24 Acceptance Testing

M. Control Cable

N. Fire Alarm System

O. Intercommunications, Clock, and Program System

P. Communication System

1.8 EQUIPMENT TO BE TESTED BY INDEPENDENT TESTING AGENCY

A. Circuit Breakers Rated 100A and Greater

B. Grounding System

C. Switchboards and Panels

1.9 SUBMITTALS

A. Submittals for this Section shall be made according to Specification Section 260100 “General Conditions for Electrical Work”.

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. All tests shall be recorded on the following forms located at the end of this section:

a. 269500 - 1 MULTIPLE CONDUCTOR CABLE MEGGER TEST, 300V AND LESS

b. 269500 - 2 SINGLE & MULTIPLE CONDUCTOR POWER CABLE MEGGER TEST, 600V AND LESS

3. 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 electronic PDF of completed report 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. Medium Voltage (Primary) Cable

1. Perform a continuity test, 2,500-volt DC megger test, AC high potential test, and a second 2,500-volt DC megger test on primary cables. The high potential test shall be performed at 45kV (or 80 percent of the factory DC test voltage, whichever is higher) for new cable installations and at 30kV when new cable has been spliced to existing cable.

2. Do not perform more than one high potential test on any item without authorization from the Owner's Representative.

3. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds and metallic shields or sheaths of the cable as the other terminal for each test.

4. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The method, voltage, length of time, and other characteristics of the test shall be in accordance with the cable manufacturer's recommendations for the particular type of cable installed, and shall not exceed the recommendations of IEEE No. 404 for cable joints (and IEEE No. 48 for cable terminations) unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing.

5. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed.

6. A test report shall be submitted to the Engineer for approval prior to energizing.

B. Secondary Switchgear

1. Perform a continuity check and 1,000 volt DC megger test on buses, and on main and feeder breakers.

2. Perform a primary current injection test and a 'Ducter' (contact resistance) test on main breakers.

3. Perform a 1,000-volt DC megger test and a turns-ratio test on CT's and PT's.

4. Calibrate the metering.

C. 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.

   g. Physically test key interlock systems to check for proper functionality.

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.

D. 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.

E. 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.

F. Distribution Transformers

1. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 2.5 percent. Submit recording and tap settings as test results.

2. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

3. Prepare a written Output Settings Report recording output voltages and tap settings.

G. Distribution Equipment

1. Megger tests shall be performed at a DC voltage of 1,000 volts for 600 volt rated equipment, and at 500 volts for 120-300 volt rated equipment.

2. Perform a 1,000-volt megger test on buses, motor starters and disconnect switches. This test may be combined with the feeder cable megger test by testing the devices and terminated cables together.

3. Perform a continuity check on motor control circuits and control panel internal wiring.

4. Perform an operational test on the controls.

5. Perform a continuity check and a 1,000-volt DC megger test on 3 phase distribution and isolation transformers.

H. Disconnect Switches

1. Check for cleanliness of contacts, operation, etc.

2. Lubricate contacts and mechanical devices.

3. Check fuse-clip tightness.

4. Perform a 1,000-volt megger test on disconnect switches rated for 600V and at 500 volts for disconnect switches rated for 240V.

I. Motors

1. Perform a 1,000-volt megger test on 460 volt, 3 phase motors, and a 500 volt megger test on 200-230 volt, 3 phase motors.

2. “Bump” motors to verify proper direction of rotation.

3. Run motors and check for vibration and overheating.

J. 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 ballasts, 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 lamps in interior lighting fixtures, which are observed to be noticeably dimmed after Contractor’s use and testing, as judged by Architect or Electrical Engineer.

3. Replace defective and burned out fluorescent or HID lamps for a period of one-year following the time of substantial completion

4. Give advance notice of dates and times for field tests.

5. Provide instruments to make and record test results.

6. 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 ballasts.

c. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:

1) Duration of supply.

2) Low battery voltage shutdown.

3) Normal transfer to battery source and retransfer to normal.

4) Low supply voltage transfer.

5) Report results of tests in wiring.

K. Title 24 Acceptance Testing

1. Perform tests as outlined in Part 3 of Specification Section 266100 – “Lighting Control Systems”.

L. Control Cable

1. Perform a continuity check on control and instrumentation wiring.

M. Fire Alarm System

1. Perform testing in accordance with NFPA 72-2016.

N. Intercommunications, Clock, and Program System

1. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components, perform the initial system programming, and oversee the pre-testing, testing and adjustment of the system.

2. Programming: Fully brief the Owner on programming options available for the system. Record his programming decisions and set up the initial programming of the system. Set system so signal devices operate on required schedules and are activated for durations selected by the Owner. Program relay output circuits to suit Owner’s operating schedule for the equipment controlled. Provide the Owner with a written record of the decisions, implementation methodology, and final results.

3. Test Procedure: Conform to the following:

a. Schedule tests a minimum of 7 days in advance of performance of tests.

b. Report: Submit a written record of inspection and test results.

c. Operational Test: Perform operational system test to verify conformance of system to these Specifications. Perform tests that include originating station-to-station, all-call, and page messages at each intercommunication station. Verify proper routing and volume levels and freedom from noise and distortion. Test each available message path from each station on the system. Include operation of all modes of clock correction and all programming and manually programmed signal and relay operating functions.

d. Frequency Response Test: Determine frequency response of 2 transmission paths, including all-call and paging by transmitting and recording audio tones. The minimum acceptable performance is within 3 dB from 150 to 2500 Hz.

e. Signal-to-Noise Ratio Test: Measure the ratio of signal to noise of the complete system at normal gain settings, using the following procedure:

1) Disconnect a speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise.

2) Repeat the test for 4 speaker microphones and for each separately controlled zone of paging loudspeakers.

3) The minimum acceptable ratio is 35 dB.

f. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each paging and all-call amplifier, and a minimum of 2 selected intercommunication amplifiers, and for each frequency, measure the distortion in the paging and all-call amplifier outputs. The maximum acceptable distortion at any frequency is 5 percent total harmonics.

g. Acoustic Coverage Test: Feed pink noise into the system using octaves centered at 500 and 4000 Hz. Use a sound-level meter with octave band filters to measure the level at 3 locations in each paging zone. The maximum permissible variation in level is plus or minus 3 dB, and the levels between adjacent zones must not vary more than plus or minus 5 dB.

h. Power Output Test: Measure the electrical power output of each paging amplifier at normal gain setting at 150, 1000, and 2500 Hz. The maximum variation in power output at these frequencies must not exceed plus or minus 3 dB.

i. Signal Ground Test: Measure and report ground resistance at the system signal ground. Conform to the testing requirements of Division 26 Section "Grounding."

4. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.

5. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

O. Communication System

1. Refer to Division 27 Sections of these Specifications for testing.

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 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

MULTIPLE CONDUCTOR CABLE MEGGER TEST, 300 VOLTS & LESS

WIRING - SIGNAL & COMMUNICATION CABLE

Testing shall be performed before connecting the cables to the terminals at either end. Continuity of each conductor shall be checked at this time. Each conductor shall be checked with a 500 volt megger to ground, with all other conductors in the cable and shield, grounded. The minimum acceptable megger resistance shall be 50 megohms for each conductor to ground.

PROJECT NAME _____

FEEDER NUMBER_____ LOCATION_____

CABLE SIZE _____ CABLE LENGTH_____

NO. OF CONDUCTORS _____ INSULATION TYPE_____

MANUFACTURER _____ LINE VOLTAGE_____

TEMPERATURE _____ HUMIDITY_____

MEGGER TYPE _____ SERIAL NUMBER_____

TEST VOLTAGE _____ MULTIPLIER_____

REMARKS_____

CONDUCTOR NO.	MEGOHMS		CONTINUITY		CONDUCTOR NO.	MEGOHMS		CONTINUITY	
	C/C	C/S	PASS	FAIL		C/C	C/S	PASS	FAIL

MEGGER TEST, 600 VOLTS & LESS

TEST PERFORMED BY_____ _____

Signature Date

TEST WITNESSED BY_____ _____

Signature Date

SINGLE & MULTIPLE CONDUCTOR POWER CABLE MEGGER TEST, 600 VOLTS & LESS

WIRING – FEEDER CIRCUITS

Testing shall be performed before connecting the cables to the terminals at either end. Continuity of each conductor shall be checked at this time. Each conductor shall be checked with a 500 volt megger to ground, with all other conductors (including shield) in the conduit or cable grounded. The minimum acceptable megger resistance shall be 50 megohms for each conductor to ground.

PROJECT NAME _____

FEEDER NUMBER_____ LOCATION_____

CABLE SIZE _____ CABLE LENGTH_____

NO. OF CONDUCTORS _____ INSULATION TYPE_____

MANUFACTURER _____ LINE VOLTAGE_____

TEMPERATURE _____ HUMIDITY_____

MEGGER TYPE _____ SERIAL NUMBER_____

TEST VOLTAGE _____ MULTIPLIER_____

REMARKS_____

Cable No	MEGOHMS Phase A	MEGOHMS Phase B	MEGOHMS Phase C

TEST PERFORMED BY_____ _____

Signature Date

TEST WITNESSED BY_____ _____

Signature Date

FOR BID ONLY

SECTION 270000
COMMUNICATIONS

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. This project requires the Contractor to provide, label, test, document, and warrant a Structured Cabling System (SCS) in conformance with this specification for the facilities of the College of the Sequoias (COS) referenced as Tulare Campus CTE.
2. Coordination of work and resolution of conflicts between project documents issued by others such as Architects, Civil Engineers, Electrical/Mechanical Engineers, Plumbing Engineers, Civil Engineers, etc. and this Division 27 specification with its conjoined construction drawings shall be the responsibility of the Contractor.

B. Related Sections:

1. Section 270600 - Schedules for Communications
2. Section 270526 - Grounding and Bonding for Communications Systems
3. Section 271100 - Communications Equipment Room Fittings
4. Section 271113 - Communications Entrance Protection
5. Section 271116 - Communications Cabinets, Racks, Frames, and Enclosures
6. Section 271119 - Communications Termination Blocks and Patch Panels
7. Section 271300 - Communications Backbone Cabling
8. Section 271513 - Communications Copper Horizontal Cabling
9. Section 271543 - Communications Faceplates and Connectors
10. Section 271553 - Communications Cable Plant Testing
11. Section 274100 - Audio Visual Systems

1.3 PRE-INSTALLATION MEETINGS:

A. During the execution phase of this project the selected Contractor shall be prepared to attend weekly progress review meetings with the Owner or their designate.

1.4 QUALITY ASSURANCE

A. The Contractor shall have a current State of California C-7 license.

B. All work shall be performed in a neat and workmanlike manner (also see Division 01).

C. Product, materials, and equipment provided by the Contractor shall be of the quality specified.

D. All materials provided under this contract shall be new and of a regularly manufactured line, currently in production at the time of installation.

E. Codes: (Most recent adopted editions with addenda/Technical Service Bulletins (TSB), etc.) All materials, installation, and workmanship shall comply with the applicable requirements and codes addressed within the following references:

1. National Electrical Manufacturers Association (NEMA).
2. California Electrical Code (CEC).
3. ANSI/IEEE C2, National Electrical Safety Code (NESC).
4. FCC Rules and Regulations.
5. Local, county, state, and federal regulations and codes in effect as of the bid submission date.

F. Standards: (Most recent adopted editions with addenda/TSB, etc.) All materials, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI/TIA-568.1-D, Commercial Building Telecommunications Infrastructure Standard
2. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard
3. ANSI/TIA-568.3-D, Optical Fiber Cabling and Components Standard
4. ANSI/TIA-568-C.4, Broadband Coaxial Cabling and Components Standard
5. ANSI/TIA-569-D, Telecommunications Pathways and Spaces
6. ANSI/TIA-570-C, Residential Telecommunications Infrastructure Standard
7. ANSI/TIA-606-B, Administration Standard for Telecommunications Infrastructure
8. ANSI/TIA-607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
9. ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard
10. ANSI/TIA-4966, Telecommunications Infrastructure Standard for Educational Facilities
11. BICSI - Telecommunications Distribution Methods Manual (TDMM)
12. BICSI - Outside Plant Design Reference Manual (OSPDRM)
13. BICSI - Wireless Design Reference Manual (WDRM)
14. All products shall be Underwriters Laboratories (UL) listed, or other nationally recognized testing laboratory acceptable to the Engineer listed for the application intended.

G. Where conflicts exist from one code or standard to another, the code or standard to adhere to will be decided by the Engineer.

1.5 COORDINATION

A. The Contractor shall coordinate the work specified in this Division 27 specification with the work of the other trades involved in this project.

B. The Contractor shall coordinate with Division 26 - Electrical concerning provision and installation of the following:

1. Conduit and cable tray pathway for communications.
2. Wall penetrations and floor coring for communications.
3. Backboxes for communications.
4. Telecommunications Space Power placement of communications.

5. Grounding and bonding for communications.

C. All questions and issues regarding coordination and construction element phasing shall be directed to the Engineer.

D. DO NOT USE drawing scale to determine exact dimensions or exact location. Scaled drawings are still to be considered diagrammatic and scale should be used for estimates only. If exact lengths or location placement dimensions are required, the drawings will specifically show those dimensions or placement coordinates.

E. The Contractor shall coordinate their work so there shall be no disruption to any occupants of the campus unless coordinated and approved by the Engineer. Any necessary disruption shall be scheduled a minimum of 4 weeks in advance of its occurrence and affected parties shall be notified in writing of date, time, and planned duration of the disruption.

F. The Contractor shall follow all rules, regulations, and instructions stipulated by this specification, general provisions of the Contract, including General and Supplementary Conditions, and Division 01 specification sections, if issued in conjunction with these Division 27 specifications regarding the following:

1. Delivery hours.
2. Delivery locations.
3. Storage.
4. Hazardous Material.
5. Security.
6. Hours of work.
7. Safety.
8. Logistics.

1.6 WARRANTIES

A. The Contractor shall provide a one (1) year material and labor warranty on all the work the Contractor has performed.

B. The Contractor shall provide the SCS system manufacturer's 25-year materials and link performance certification warranty for all new cable installed by the Contractor in his execution of the work of this specification.

1.7 MATERIAL SUBSTITUTIONS

A. All requests for substitutions of products shall be made and approved or disallowed during the stated bid period for this project - see Division 01.

B. Electronic PDF and a URL reference of all proposed product substitution documentation are required. Proposed product substitution documentation shall contain, at a minimum, the following:

1. The product manufacturer's performance specifications cut sheet(s).
2. If existing, the manufacturer's installation instructions and/or installation recommendations for that product.

C. Acceptance of proposed substitutions is at the discretion of the Owner. Allow 10 working days for review and final decision.

D. Substitutions must comply with the warranty requirements specified above.

1.8 SUBMITTALS

A. A complete network drop numbering plan set in COS drop numbering format in printed and electronic format (Autocad is preferred).

B. Mock-ups of each type of network drop faceplate to be provided for this project. Each drop mock-up shall contain the following:

1. Full load of required connectors with eighteen inches (18") of connector type appropriate specified cable terminated on each connector.
2. Required drop faceplate labeling to include faceplate icons as required by these Division 27 Specifications and the accompanying construction drawing set.

C. Manufacturers' cut sheets for all products to be supplied by the Contractor in response to these Division 27 specification sections.

D. A copy of the Contractor's C-7 license.

E. A copy of testing personnel certification(s) that show they are properly trained in the use of the testing equipment that will be employed by the contractor - reference Section 271553 - Cable Plant Testing.

F. Testing device(s) calibration documentation.

G. Copies of Contractor's Structured Cabling System (SCS) manufacturer's authorized vendor/installer Certification document(s).

H. Required submittals prior to final acceptance.

1. Two (2) sets of CDs or DVDs of the as-built drawings (AutoCAD or AutoCAD Lite Rev 2014 or later)
2. Two (2) sets of CDs or DVDs of cable plant testing documentation - reference Section 271553 - Cable Plant Testing.
3. Two (2) copies of required warranties.

PART 2 - PRODUCTS

2.1 SCHEDULES FOR COMMUNICATIONS

A. Section 270600, Schedules for Communications presents the pre-approved Product/Material. In this specification set product/material shall be specified by reference to the Product/Materials Schedule contained in Section 270600 - Schedules for Communications.

B. The Contractor shall supply a complete and functioning system; if a product/material required for this project is not listed in Section 270600 - Schedules for Communications, Products and Materials Schedule, it shall be provided by Contractor with submittal approval by the Engineer.

C. The Product and Materials Schedule allows for "or equal" substitutions. When "or equal" product/material is substituted, the "or equal" product/material submitted shall be equivalent in every way to the product/material listed in Section 270600 - Schedules for Communications, the Products and Materials Schedule - see Material Substitutions above. All products that the Contractor would like to submit as an “or equal” product must be submitted and approved by the Engineer.

2.2 QUANTITIES

A. Determining quantity of any given required item or product shall be the Contractor's responsibility using this specification and accompanying drawing set.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all required materials, equipment, and tools necessary to properly complete the work of these specifications including, but not limited to, tools for pulling and terminating the cables, mounting hardware, ladders, lift equipment, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, technician communication devices, cable testing equipment, stands for cable reels, cable wenches, etc.

3.2 EXAMINATION

A. The Contractor is responsible for examining existing conditions and comparing them with drawings and specifications and notifying the ITPC or his/her designate of any discrepancies.

B. The Contractor is responsible for coordinating with the ITPC or his/her designate to address, adjust, and resolve any discrepancies found before commencing work.

C. If a discrepancy between existing conditions and these drawings and specifications is found after commencing work, stop any work that in the Contractor's opinion is affected by the found discrepancy. It shall then be the Contractor's responsibility to resolve all issues caused by the found discrepancy before commencing work in work areas affected by the discrepancy.

3.3 VERIFICATION

A. It is incumbent upon the Contractor to verify that the installation and materials used have been inspected before they are enclosed within building features, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected and approved.

B. After installation, test, certify, and provide required warranties for the Structured Cabling System installed per the requirements of this specification.

3.4 ADJUSTMENTS

A. The Contractor is responsible for coordinating and documenting with the ITPC or his/her designate the change order process. Coordinate specific needed forms and procedures for change orders with the ITPC or his/her designate.

3.5 LABELING

A. The Contractor is responsible for labeling and documenting all aspects of the installed infrastructure. The Contractor will not receive acceptance or final payments until the ITPC agrees that labeling and documentation is completed for the project.

B. Confirm labeling scheme with Owner prior to completion.

C. Each patch panel in the TR would be labeled with a patch panel number only (P1, P2, P3, etc). The manufacture jack labeling, numbers 01-48, would be used to indicate the jack number of the cables connected to the patch panel.

D. An as-built floor plan of the coverage area of the TR will be mounted inside each TR by the Contractor. The floor plan will show the rooms and drop locations fed by the TR. The physical drop faceplate and the drop location on the as-built floor plan will be labeled with the TR identification, patch panel, and jack number for each cable fed by the TR. An example of a typical 2 port drop location with two cables connected to ports 10 and 11 on patch panel 2 in TR 2a is shown below:

3.6 LIST OF REQUIRED AS-BUILT DRAWINGS

A. As stated under "Submittals" above, as-built drawing files shall be "AutoCAD" or "AutoCAD Lite" 2014 or later release.

B. The list of required as-built drawings is as follows:

1. All cabling drop faceplate locations with identification for each jack at that drop.
2. Two-inch (2”) and larger conduit pathways to include conduit size label.
3. Pull box locations.
4. Two-inch (2”) and four-inch (4”) J hook runs indicated by a line series of “x”s.
5. MDF/IDF layout labeled per current construction drawing field mark-ups.
6. Rack elevation labeled per current construction drawing field mark-ups.
7. Backbone copper and fiber schematic drawings with labeling information.
8. Updated outside plant drawings showing pathway, manholes, and pullboxes.

C. After review of as-built drawings by the Engineer be prepared to make any required corrections for final submittal.

3.7 ACCEPTANCE

A. The project specified by this specification shall be considered completed and signed off as completed by the Engineer contingent upon the following:

1. All punch lists have been completed and signed as complete by the Engineer.

2. Required cable plant testing has been executed and required test result documentation has been submitted and approved by the Engineer - Refer to Section 271553 - Communications Cable Plant Testing.
3. Any required adjustments to as-built drawings have been completed, submitted, and approved as complete by the Engineer.
4. Required warranty documentation has been submitted and approved as complete by the Engineer.

END OF SECTION

SECTION 270526
GROUNDING AND BONDING FOR COMMUNICATIONS 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. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication bonding required by these specifications and related construction drawings.

B. Related Sections

1. Division 26 - Electrical
2. Section 270000 - Communications
3. Section 270600 - Communications Schedules
4. Section 271100 - Communications Equipment Room Fittings
5. Section 271113 - Communications Entrance Protection
6. Section 271116 - Communications Cabinets, Racks, Frames, and Enclosures
7. Section 271119 - Communications Termination Blocks and Patch Panels.
8. Section 271300 - Communications Backbone Cabling

1.3 QUALITY ASSURANCE

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCTS

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 BUSBARS

A. Provide all required telecommunications grounding system busbars - see Section 270600 - Schedules for Communications.

2.3 GROUNDING AND BONDING CONDUCTORS

A. Provide all required 6 AWG green thermoplastic insulated stranded copper wire - see Section 270600 - Schedules for Communications.

2.4 GROUNDING AND BONDING CONDUCTOR TERMINATIONS

A. Provide all required two-hole compression lugs: Color coded to appropriate cable, high conductivity wrought copper, electro tin plated - see Section 270600 - Schedules for Communications.

B. All bonding compression lugs and other bonding hardware shall be Underwriters Laboratories (UL), or other nationally recognized testing laboratory acceptable to the Engineer, listed for the application intended.

PART 3 - EXECUTION

3.1 GENERAL

A. The contractor shall comply with all requirements as listed in ANSI/TIA/EIA-STD-607-A “Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications” whether shown on the drawings or not.

3.2 INSTALLATION

A. Install busbars per manufactures instructions and at locations shown on the accompanying drawings. If locations are unclear, clarify location with the Engineer before installing.

B. Provide all bonding as specified by these Division 27 specifications and the conjoined construction drawings. In particular make sure, when present in a Telecommunication Room (TR), that the following elements are bonded:

1. Metallic equipment racks.
2. Cable shields.
3. All metal raceways and cable trays.

C. Bonding conductors shall be continuous and routed in as direct a route as possible to the point of termination while adhering to the following: No bonding conductor shall vertically traverse a wall except at wall corners.

D. Clean ground bars prior to terminating bonding conductors.

3.3 EXAMINATION

A. Comply with Section 270000 – Communications.

3.4 LABELING

A. Reference construction drawings accompanying this Division 27 specification.

B. Comply with Section 270000 – Communications.

C. Label all telecommunications bonding conductors as close as possible to the termination points with an ANSI/TIA/EIA 606 compliant label for bonding.

3.5 AS-BUILT DRAWINGS

A. Comply with Section 271553 - Communications Cable Plant Testing.

B. Comply with Section 270000 – Communications.

END OF SECTION 270526

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SECTION 270600
SCHEDULE FOR COMMUNICATIONS

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. This section includes the pre-approved Product/Material. In this specification set product/material shall be specified by reference to the Product/Materials Schedule.

B. Related Sections

1. Section 270000 - Communications
2. Section 270526 - Grounding and Bonding for Communications Systems
3. Section 271100 - Communications Equipment Room Fittings
4. Section 271113 - Communications Entrance Protection
5. Section 271116 - Communications Cabinets, Racks, Frames, and Enclosures
6. Section 271119 - Communications Termination Blocks and Patch Panels
7. Section 271300 - Communications Backbone Cabling
8. Section 271513 - Communications Copper Horizontal Cabling
9. Section 271543 - Communications Faceplates and Connectors
10. Section 271553 - Communications Cable Plant Testing
11. Section 274100 - Audio Visual Systems

1.3 QUALITY ASSURANCE

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

B. Any submittal of an "or equal" product must contain the product manufacturer's performance specifications cut sheet for that product.

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. 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.

c. Items not showing manufacturer and part # shall be furnished by the Contractor with submittal approval by the COS Information Technology Team.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCTS

2.1 PRODUCT/MATERIALS SCHEDULE

A. The Contractor shall supply a complete and functioning system; if a product/material required for this project is not listed, it shall be provided by Contractor with submittal approval by the Engineer.

B. The Product and Materials Schedule allows for "or equal" substitutions. When "or equal" product/material is substituted, the "or equal" product/material submitted shall be equivalent in every way. All products that the Contractor would like to submit as an “or equal” product must be submitted and approved by the Engineer.

C. Not all items listed in following table are necessarily required for this project.

D. If Line #’s appear not to be sequential, those items have been removed since they are not required for this project.

Line #	Division 27 Section Number	Division 27 Section Name	Approved Manufacturer	Part #	As Specified, Or Equal	Description
1	270526	Grounding and Bonding for Communications Systems	Cooper B-Line	SB47902	Or Equal	Two-hole compression lugs
2	270526	Grounding and Bonding for Communications Systems			Or Equal	6 AWG, green insulation, bonding wire
3	270526	Grounding and Bonding for Communications Systems	Panduit	LTYK	Or Equal	J-STD-607-A Compliant Bonding Tag
4	270526	Grounding and Bonding for Communications Systems	Cooper B-Line	SB6693/4X101/2	Or Equal	Grounding Strap
5	270526	Grounding and Bonding for Communications Systems	Chatsworth Products	10610-019	Or Equal	Horizontal Rack Grounding Busbar
6						
7	271100	Communications Equipment Room Fittings	Chatsworth Products	11275-712	Or Equal	12" Cable Runway
8	271100	Communications Equipment Room Fittings	Chatsworth Products	11301-001	Or Equal	Butt Splice
9	271100	Communications Equipment Room Fittings	Chatsworth Products	11312-718	Or Equal	Triangular Runway Wall Support Kit
10	271100	Communications Equipment Room Fittings	Chatsworth Products	11302-701	Or Equal	Runway 90 degree junction Splice Clamp and Kit
11	271100	Communications Equipment Room Fittings	Chatsworth Products	11421-712	Or Equal	Runway Wall Angle Support Kit
12	271100	Communications Equipment Room Fittings	Chatsworth Products	0506-716	Or Equal	Runway Elevation Kit for Cabinets
13	271100	Communications Equipment Room Fittings	Chatsworth Products	10506-706	Or Equal	Runway Elevation Kit for Racks
14	271100	Communications Equipment Room Fittings	Chatsworth Products	12730-712	Or Equal	Runway Rack Mounting Plate
15	271100	Communications Equipment Room Fittings	Chatsworth Products	40164-001	Or Equal	Cable Runway Grounding Strap Kit
16	271100	Communications Equipment Room Fittings	Chatsworth Products	11309-701	Or Equal	Foot Kit Cable Runway
17	271100	Communications Equipment Room Fittings	Chatsworth Products	10608-701	Or Equal	Vertical Wall Brackets
18	271100	Communications Equipment Room Fittings	Chatsworth Products	10873-001	Or Equal	Slip-On Support Bracket

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19	271100	Communications Equipment Room Fittings	Chatsworth Products	30139-719	Or Equal	1RU Horizontal Wire Manager – Front Only – With Cover
20	271100	Communications Equipment Room Fittings	Chatsworth Products	30130-719	Or Equal	2RU Horizontal Wire Manager – Front Only – With Cover
21	271100	Communications Equipment Room Fittings	Chatsworth Products	40098-703	Or Equal	7' Vertical Cable Manager – 6”
22	271100	Communications Equipment Room Fittings	Chatsworth Products	40099-703	Or Equal	7' Vertical Cable Manager – 10”
23						
24	271113	Communications Entrance Protection	Circa	1880ECA1-25	Or Equal	Twenty-Five (25) pair BET technology
25	271113	Communications Entrance Protection	Circa	4B3S-75	Or Equal	3 pin, solid-state technology protectors
26						
27						
28	271116	Communications Cabinets, Racks, Frames and Enclosures	Chatsworth Products	M1043-741	Or Equal	Floor Mount Cabinet - 19" x 45 RMU x 39" D
29	271116	Communications Cabinets, Racks, Frames and Enclosures	Chatsworth Products	46353-705	Or Equal	2-Post Rack
30	271116	Communications Cabinets, Racks, Frames and Enclosures	Chatsworth	11996-724	Or Equal	Wall Mount Cabinet – 24"W x 24”H x 30" D
31						
32	271119	Communications Termination Blocks and Patch Panels	Siemon	HD6-48	Or Equal	CAT 6 48 port modular patch panels
33	271119	Communications Termination Blocks and Patch Panels	Siemon	HD6-24	Or Equal	CAT 6 24 port modular patch panels
34	271119	Communications Termination Blocks and Patch Panels	Siemon	RIC3-48-01	Or Equal	3 RU Fiber optic patch panel
35	271119	Communications Termination Blocks and Patch Panels	Siemon	FCP3-DWR	Or Equal	1 RU Fiber optic patch panel
36	271119	Communications Termination Blocks and Patch Panels	Siemon	RIC-F-LCE24-01C	Or Equal	Fiber adapter plate, 24 Fiber, LC, Erika Violet Adapter
37						
38	271300	Communications Backbone Cabling	General Cable	7525758	Or Equal	OSP Backbone Copper Cable – 25 Pair
39	271300	Communications Backbone Cabling	Berk-Tek	OPDD12B024FB3010/F5	Or Equal	OSP Backbone Fiber Optic Cable – 24 Strand – OM4 – Loose Tube
40	271300	Communications Backbone Cabling	Berk-Tek	10033625	Or Equal	Field Breakout Kit – 12 buffer tubes, 36”
41						
42	271513	Communications Copper Horizontal Cabling	Berk-Tek	LANmark-1000	Or Equal	Category 6, Plenum Rated, Blue Jacket
43	271513	Communications Copper Horizontal Cabling	Berk-Tek	LANmark-XTP	Or Equal	Category 6A, Plenum Rated, Blue Jacket
44						
45	271543	Communications Faceplates and Connectors	Siemon	MX-FP-S-02-02	Or Equal	Data faceplate – 2 Port
46	271543	Communications Faceplates and Connectors	Siemon	MX-FP-S-04-02	Or Equal	Data faceplate – 4 Port
47	271543	Communications Faceplates and Connectors	Siemon	MX-FP-S-06-02	Or Equal	Data faceplate – 6 Port
48	271543	Communications Faceplates and Connectors	Siemon	MX-SM2-02	Or Equal	Surface Mount Box – 2 Port
49	271543	Communications Faceplates and Connectors	Siemon	MX6-06	Or Equal	Data Termination – Category 6, Blue
50	271543	Communications Faceplates and Connectors	Siemon	Z6A-06	Or Equal	Data Termination – Category 6A, Blue
51	271543	Communications Faceplates and Connectors	Siemon	MC6-05-06	Or Equal	Work Area Patch Cords – Category 6, 16.4’
52	271543	Communications Faceplates and Connectors	Siemon	MC6-XX-02	Or Equal	Patch Cords – 40% 3.3’, 40% 6.6, 20% 9.8’
53	271543	Communications Faceplates and Connectors	Siemon	ZM6A-03-06	Or Equal	WAP Patch Cord – Category 6A, 3’
54						

PART 3 - NOT USED

END OF SECTION 270600

SECTION 271100
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of equipment room fittings as called for in these specifications and accompanying drawings.

B. Related Sections

1. Division 26 - Electrical
2. Division 28 - Electronic Safety and Security
3. Section 270000 - Communications
4. Section 270600 - Communications Schedules
5. Section 270526 - Grounding and Bonding for Communications Systems
6. Section 271113 - Communications Entrance Protection
7. Section 271116 - Communications Cabinets, Racks, Frames, and Enclosures
8. Section 271119 - Communications Termination Blocks and Patch Panels.
9. Section 271513 - Communications Copper Horizontal Cabling

1.3 QUALITY ASSURANCE

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCTS

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 CABLE TRAY

A. Provide all required cable tray - see Section 270600 - Schedules for Communications.

B. Provide all required of the following:

1. Butt Splices;
2. Triangle Wall Brackets;
3. Junction Splices;
4. Wall Angle Support Kits;
5. Cable Tray Elevation Kits;
6. Single Earthquake Brackets;
7. Waterfall upper trays;
8. Horizontal Cable Managers;
9. Upper Tray Cable Managers;
10. ANSI/TIA/EIA STD-607-A Compliant Bonding Tags.

C. See Section 270600 - Schedules for Communications.

2.3 EQUIPMENT RACK VERTICAL CABLE MANAGERS

A. Provide all required vertical cable managers; see Section 270600 - Schedules for Communications.

2.4 EQUIPMENT RACK HORIZONTAL CABLE MANAGERS

A. Provide all required horizontal cable managers; see Section 270600 - Schedules for Communications.

2.5 CABLE TRAY & CABLE MANAGER PIECE PARTS AND ACCESSORIES

A. Provide all other piece parts and accessories to complete the accompanying construction drawing set communications room layouts. Use only manufacturer-supplied and/or manufacturer- provided hardware.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall make field adjustments and resolve conflicts between accompanying construction drawings, specifications, and field conditions before beginning cable tray and/or vertical cable manager installation.

3.2 INSTALLATION

A. Install all cable tray, vertical cable managers, horizontal cable managers, and associated components per manufacturer's instructions as required for a seismic zone four (4) location.

B. Cable tray shall be supported at intervals of no greater than every four (4) feet.

C. Follow cable tray, vertical cable manager, and horizontal cable manager elevations and layout patterns that are specified in the accompanying construction drawings as closely as field conditions will permit. Any proposed deviations, including those caused by field conditions, must be approved by the Engineer.

3.3 EXAMINATION

A. Comply with Section 270000 – Communications.

3.4 ADJUSTMENTS

A. Comply with Section 270000 – Communications.

3.5 AS BUILT DRAWINGS

A. Comply with Section 270000 – Communications.

3.6 ACCEPTANCE

A. Comply with Section 270000 – Communications.

END OF SECTION 271100

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SECTION 271113
ENTRANCE PROTECTION FOR COMMUNICATIONS 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. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of outside plant cable (OSP) Building Entrance Terminal (BET) protection and termination for copper cabling as called for in these specifications and related drawings.

B. Related Sections

1. Division 26 - Electrical
2. Section 270000 - Communications
3. Section 270600 - Communications Schedules
4. Section 271100 - Communications Equipment Room Fittings
5. Section 271116 - Communications Cabinets, Racks, Frames, and Enclosures
6. Section 271119 - Communications Termination Blocks and Patch Panels.
7. Section 271300 - Communications Backbone Cabling

1.3 QUALITY ASSURANCE

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

B. Coordinate location of entrance protection with the Owner.

PART 2 - PRODUCTS

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 MATERIALS AND FABRICATION

A. Building Entrance Terminal (BET) technology to include fusible link.

B. Protector technology: 5-Pin, 300V, 350 mA.

C. Miscellaneous parts and material required to complete a successful installation of the BET technology, such as splice case and associated hardware

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with Section 270000 - Communications.

3.2 EXAMINATION

A. Comply with Section 270000 – Communications.

3.3 INSTALLATION

A. Copper outside plant cabling

1. Install a Building Entrance Terminal for every 100 pairs of OSP entrance cable or entrance tie cable as specified in the drawings.
2. Mount the units in columns of not more than three, with the top surface of the upper-most unit 6 feet A.F.F. Use mounting hardware recommended by the manufacturer.
3. Bond all protectors in each BET together using 1/0 AWG (6 AWG allowed) ground wire, in daisy chain style. Connect a segment of ground wire from the top unit to the Telecommunication Grounding Buss Bar in the telecommunications room. Install 100 5- pin protector units for each BET.
4. Splice entrance cable or entrance tie cable to 26 AWG BET fuse cable pigtails. Secure the splice case vertically on the TR wall as shown on the contract drawings.
5. The Contractor shall bond the shield of each OSP cable to the Telecommunication Grounding Buss Bar (TGBB) provided at the entrance facilities using 1/0 AWG copper wire.
6. At the termination end of multi-pair OSP cables, the Contractor shall provide six feet of managed service slack.
7. Label Building Entrance Terminals according standards listed in section 270000 - Communications.

B. Test all terminated pairs of each copper backbone cable segment from the BET output field through the installed protector for the following:

1. Continuity to remote end.
2. Shorts between any two or more conductors.
3. Transposed pairs.
4. Reversed pairs.
5. Split pairs.
6. Grounded conductor.
7. Shield continuity.

3.4 LABELING

A. Label all OSP and telecommunications bonding conductors as close as possible to the termination points with an ANSI/TIA/EIA 606 compliant label for bonding.

B. Comply with Section 270000 – Communications.

3.5 AS-BUILT DRAWINGS

A. Comply with Section 270000 – Communications.

END OF SECTION 271113

SECTION 271116
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

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. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication cabinets, racks, frames and enclosures as called for in this Section of the Division 27 specifications and accompanying construction drawings.

B. Related Sections:

1. Section 270000 - Communications
2. Section 270526 - Grounding and Bonding for Communications Systems
3. Section 270600 - Communications Schedules
4. Section 271100 - Communications Equipment Room Fittings
5. Section 271113 - Communications Entrance Protection
6. Section 271119 - Communications Termination Blocks and Patch Panels.
7. Section 271513 - Communications Copper Horizontal Cabling
8. Section 271553 - Cable Plant Testing
9. Division 26 - Electrical
10. Division 28 - Electronic Safety and Security

1.3 QUALITY ASSUARNCE

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCTS

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 CABINETS

A. Provide all required cabinets - see Section 270600 - Schedules for Communications.

B. Provide all required piece parts and hardware to construct and outfit the cabinets as shown on the construction drawing set accompanying this specification.

2.3 RACKS

A. Provide all required 4-post equipment racks - see Section 270600 - Schedules for Communications.

B. Provide all required piece parts and hardware to construct and outfit the equipment racks as shown on the construction drawing set accompanying this specification.

PART 3 - EXECUTION

3.1 GENERAL

A. Before anchoring cabinets, racks, or frames to floor, wall, or overhead runway/cable tray in any telecom room, review their in place layout with the Engineer. When they give approval of in place layout, proceed with anchoring.

B. The Contractor shall comply with all SCS bonding requirements as listed in ANSI/TIA/EIA-STD- 607-A “Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications” whether shown on the accompanying drawings or not.

3.2 INSTALLATION

A. Install all cabinets, racks, frames, and enclosures per manufacturers’ installation specification, instructions, and recommendations as required for a seismic zone four (4) location.

B. Bond all cabinets, racks, frames, and enclosures to the Telecommunication Grounding Buss Bar (TGBB) using 6 AWG Green thermoplastic insulated stranded copper wire.

3.3 LABELING

A. Comply with Section 270000 - Communications.

B. Before labeling any equipment rack or cabinet confer with the Owner to determine label content and placement.

3.4 AS BUILT DRAWINGS

A. Comply with Section 270000 - Communications.

END OF SECTION 271116

SECTION 271119
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

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. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication blocks and patch panels as called for in this section of the Division 27 specifications and conjoined construction drawings.

B. Related Sections:

1. Section 270000 - Communications
2. Section 270600 - Communications Schedules
3. Section 271113 - Communications Entrance Protection
4. Section 271300 - Communications Backbone Cabling
5. Section 271513 - Communications Copper Horizontal Cabling
6. Section 271553 - Cable Plant Testing
7. Division 28 - Electronic Safety and Security
8. Division 26 - Electrical

1.3 QUALITY ASSURANCE

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCTS

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 COPPER TERMINATION BLOCKS

A. Provide all 110 (or approved equal) termination block fields required to terminate the copper backbone (riser) cabling and the voice cross-connect system cabling - Reference Section 271513 - Communications Horizontal Cabling.

B. Provide all required 110 system (or approved equal) C4 and C5 termination blocks.

C. Provide all required pair grouping 110 (or approved equal) termination block label strips.

D. See Section 270600 - Schedules for Communications.

2.3 COPPER PATCH PANELS

A. Provide all patch panels required to support the TR terminations of the horizontal cabling.

B. Provide all patch panels required to support the voice cross-connect system - Reference Section 271513 - Communications Horizontal Cabling.

C. See Section 270600 - Schedules for Communications.

2.4 BACKBONE FIBER PATCH PANELS

A. Provide all required wall mount fiber patch panels - see Section 270600 - Schedules for Communications.

B. Provide all required rack mount fiber patch panels - see Section 270600 - Schedules for Communications.

C. Provide all fiber patch panel piece parts required for the termination of SMF and MMF optical fiber backbone cables and complete build-out of associated fiber patch panels including blank fill plates - see Section 270600 - Schedules for Communications.

D. SMF fiber connectors: Provide all required SMF connector "Pigtails" - see Section 270600 - Schedules for Communications.

E. MMF fiber connectors: Provide all required MMF connector "Pigtails" - see Section 270600 - Schedules for Communications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Copper backbone termination.

1. Mount 110 (or approved equal) termination fields per manufacturer's specifications, instructions, and recommendations. Use accompanying construction drawing set to determine mounting locations and configurations.
2. Backbone cables are to be routed neatly on overhead cable runway to block termination locations. For cable management from cable runway to block termination and the dressing of cable at the blocks, follow manufacturer's specifications, instructions, and recommendations and standard industry practices.
3. Terminate all riser backbone cables per manufacturer's specifications, instructions, and recommendations.
4. At the termination end of multi-pair riser cables, the Contractor shall provide 15 feet (15') of managed service slack.
5. If removal of the cable jacket is required to facilitate routing of ARMM or plenum backbone cable into the blocks, the exposed cable pairs shall be fully covered with black or gray plastic tape, neatly lapped to prevent gaps.
6. Install five (5) pair and four (4) pair 110 I.D. strips for backbone cabling as required per the construction drawing set accompanying this Division 27 specification.

B. Cable drop horizontal cable termination.

1. Install one (1) 48-port patch panel for every 48 horizontal UTP data cables.
2. Mount patch panels per the construction drawing set accompanying this Division 27 specification. Note: See Section 271100 - Communications Equipment Room Fittings.
3. Horizontal cables are to be routed neatly on overhead cable runway to equipment racks; exit cable runway into equipment rack vertical cable management and proceed to the patch panels.
4. Cable termination.

   a. Cables on the left side of the patch panel shall enter from the left side vertical cable manager. Cables on the right side of the patch panel shall enter from the right side vertical cable manager. Cables shall not cross the center line of the patch panel.
   b. Terminate cables using the 8-pin jack, T568-B four (4) pair termination standard and comply with manufacturer's termination practices, specifications, instructions, and recommendations.

C. Voice cross-connect system termination.

1. 110 or approved equal cable end termination.

   a. Mount 110 (or approved equal) termination fields per manufacturer's specifications, instructions, and recommendations. Use accompanying construction drawing set to determine mounting locations and configurations.
   b. 110 or approved equal C4 blocks shall be used for all but the last position on each twenty-five (25) pair row of a 110 one hundred (100) pair field and C5 blocks for the last five (5) pair positions in each twenty-five (25) pair row.

2. Patch panel end terminations.

   a. Install one (1) 24-port patch panel for voice cross-connect system to 110 block.
   b. Mount patch panels per the construction drawing set accompanying this Division 27 specification. Note: See Section 271100 - Communications Equipment Room Fittings. Each patch panel shall have a 2RU horizontal manager placed both above and below the panel.
   c. Terminate multi-pair copper cables using termination standard and comply with manufacturer's termination practices, specifications, instructions, and recommendations at 110 block and 24-port patch panel.

D. Fiber backbone cable termination.

1. Install at the locations indicated on the construction drawing set and per manufacturer's specifications, instructions, and recommendations the wall mount and rack mountoptical fiber patch panels.
2. Fiber backbone cables are to be routed neatly on overhead cable runway to patch panel termination locations. For cable management from cable runway to patch panel termination and the dressing of cable at the patch panel termination, follow manufacturer’s specifications, instructions, recommendations, and standard industry practices.
3. Before terminating fiber backbone cable neatly install twenty-five feet (25') of service loop slack on Telecommunication Room wall near location where backbone cable is to be terminated. Diameter of service loops shall be eighteen inches (18").
4. Terminate fiber backbone cable by fusion splicing the appropriate connector "Pigtail" to the backbone cable. Comply with manufactures specifications, instructions, and recommendations.
5. Fiber connector "Pigtail" splicing: Use only fusion splicing to splice fiber connector pigtails to fiber backbone cable. No other splicing methodology shall be allowed.

3.2 EXAMINATION

A. Comply with Section 270000 – Communications.

3.3 ISP/OSP BACKBONE COPPER 110 TERMINATION BLOCK LABELING

A. Comply with Section 270000 – Communications.

B. Confirm labeling scheme with Owner prior to completion.

C. Pair call-out labeling: Pair call-out labeling shall designate every fifth (5th) pair consecutively through total pair count of the cable terminated on the block but not including the first (1st) and twenty-fifth (25th) pairs of each twenty-five (25) pair field bundle: Example for fifty (50) pair cable -- 5, 10, 15, 20, 30, 35, 40, 45.

D. All labels shall be machine/printer created labels. Hand labeling is not acceptable unless approved in writing as acceptable by the Owner.

3.4 HORIZONTAL COPPER PATCH PANEL LABELING

A. Comply with Section 270000 – Communications.

B. Label placement.

1. Label each patch panel with a patch panel number. P1 for patch panel 1, P2 for patch panel 2, etc.
2. Modular jack assignment number and TR patch panel port number shall be the same number.

C. All labels shall be machine/printer created labels. Hand labeling is not acceptable unless approved in writing as acceptable by the Owner.

3.5 BACKBONE FIBER PATCH PANEL LABELING

A. Comply with Section 270000 – Communications.

B. Each backbone fiber patch panel shall have a header label.

C. Confirm labeling scheme with Owner prior to completion.

D. Fiber Patch Panel Port Labeling: Label each fiber patch panel port with the strand count terminated on the port.

E. All labels shall be printed labels. Hand labeling is not acceptable unless approved in writing as acceptable by the Owner.

3.6 TESTING

A. Comply with Section 271553 - Communications Cable Plant Testing.

3.7 AS-BUILT DRAWINGS

A. Comply with Section 270000 – Communications.

3.8 ADJUSTMENTS

A. Comply with Section 270000 – Communications.

3.9 ACCEPTANCE

A. Comply with Section 270000 – Communications.

END OF SECTION 271119

SECTION 271300
COMMUNICATIONS BACKBONE CABLING

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. Sections Include

1. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation and termination of new backbone cabling as specified in this section ofthe specifications.
2. The backbone portion of the cabling system specified in this section provides a connection between MDF/IDF rooms within this building and to remote buildings on campus.

B. Related Sections:

1. Division 26 – Electrical
2. Section 270000 - Communications
3. Section 270600 - Schedules for Communications
4. Section 271100 - Communications Equipment Room Fittings
5. Section 271119 - Communications Termination Blocks and Patch Panels
6. Section 271513 – Communications Copper Horizontal Cabling
7. Section 271543 - Communications Faceplates and Connectors
8. Section 271553 - Communications Cable Plant Testing

1.3 QUALITY CONTROL

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCT

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 OPTICAL FIBER CABLE

A. Provide all required cable and fanout kits - see Section 270600 - Schedules for Communications.

2.3 COPPER BACKBONE CABLING

A. Provide all copper backbone cable required to support the voice services cross-connect system- see Section 270600 - Schedules for Communications.

PART 3 - EXECUTION

3.1 GENERAL

A. All cable runs shall be installed per manufacturer's installation instructions.

B. Cable installation is “home-run” between each MDF/IDF.

1. Each cable shall be installed without any splices.
2. Each cable shall be installed without intermediate termination points unless approved by Engineer.

3.2 EXAMINATION

A. Comply with Section 270000 – Communications.

3.3 BACKBONE CABLE PLACEMENT

A. No cable shall run unsupported by conduit, cable tray, hangers, or other specified supportfor distances greater than five feet (5’).

B. Inner ducts shall be installed with fiber through any new conduits.

C. No cable or cable bundle shall be supported by or attached by any means to fire sprinkler heads, delivery system hardware, environmental sensor system hardware, or the exterior of any conduit, ladder rack, or cable tray. Cable shall be supported by systems specifically installed for cable support.

D. Where cable being installed is not enclosed in conduit or cable tray, cross all electrical power circuit transport at right angles.

E. Where discontinuity of cable trays or conduit pathway occurs that causes cable or cable bundle to sag vertically three inches (3") or more, support the cable or cable bundle over the discontinuity using hangers, brackets, hooks, rings, and other applicable supporting devices specified.

F. During placement of cable runs, do not exceed manufacturer's maximum pulling tension or minimum bend radius limits.

G. Manage slack to avoid excess cable or kinking.

H. Pull new pulling tape through all conduits while placing new cable. Leave a pulling tape in the utilized conduits for future use.

I. Do not roll or store cable reels without an appropriate underlay.

J. Maintain the following clearances from EMI sources:

1. Unshielded power lines or equipment less than or equal to 5 kVA near cable in open or non-metal pathway: twelve inches (12").
2. Unshielded power lines or equipment greater than 5 kVA near cable in open or non-metal pathway: twenty-four inches (24").
3. Unshielded power lines or equipment less than or equal to 5 kVA near cable in grounded metal pathway: six inches (6").
4. Unshielded power lines or equipment greater than 5 kVA near cable in grounded metal pathway: twelve inches (12").
5. Power lines enclosed in grounded metal conduit less than or equal to 5 kVA near cable in grounded metal pathway: three inches (3").
6. Power lines enclosed in grounded metal conduit greater than 5 kVA near cable in grounded metal pathway: six inches (6").
7. Fluorescent fixtures near cable in open or non-metal pathway: twelve inches (12").
8. Fluorescent fixtures near cable in grounded metal conduit: six inches (6").
9. Motors or transformers near cable in non-metal pathway: forty-eight inches (48").
10. Motors or transformers near cable in grounded metal pathway: thirty-six inches (36").
11. Radiating coaxial cabling: six inches (6”).

3.4 TERMINATION

A. Comply with Section 271119 - Communications Termination Blocks & Patch Panels and Section 271543 - Communications Faceplates and Connectors.

3.5 LABELING

A. Comply with Section 270000 – Communications.

B. Label placement: Attach a label to both ends of each cable six inches (6") from the cables termination at the drop and TR patch panel port.

C. All labels shall be machine created labels. Hand labeling is not acceptable.

3.6 TESTING

A. Comply with Section 271553 - Communications Cable Plant Testing.

3.7 AS-BUILT DRAWINGS

A. Comply with Section 270000 – Communications.

3.8 VERIFICATION

A. Comply with Section 270000 – Communications.

3.9 ADJUSTMENTS

A. Comply with Section 270000 – Communications.

3.10 ACCEPTANCE

A. Comply with Section 270000 – Communications.

END OF SECTION 271300

FOR BID ONLY

SECTION 271513
COMMUNICATIONS COPPER HORIZONTAL CABLING

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. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation and termination of new horizontal cabling as specified in this section of the specifications.
2. The horizontal link portion of the cabling system specified in this section extends from the modular jack termination of the cable at the drop faceplate to its patch panel modular jack termination in its assigned telecommunication room (TR).

B. Related Sections:

1. Division 26 – Electrical
2. Section 270000 - Communications
3. Section 270600 - Schedules for Communications
4. Section 271100 - Communications Equipment Room Fittings
5. Section 271119 - Communications Termination Blocks and Patch Panels
6. Section 271543 - Communications Faceplates and Connectors
7. Section 271553 - Communications Cable Plant Testing

1.3 QUALITY CONTROL

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCT

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 HORIZONTAL CABLE

A. Provide all required horizontal cable - see Section 270600 - Schedules for Communications.

PART 3 - EXECUTION

3.1 GENERAL

A. All cable runs shall be installed per manufacturer's installation instructions.

B. Cable installation is “home-run” between the modular jack termination of the cable at the faceplate drop to the patch panel modular jack termination in its assigned TR.

1. Each cable shall be installed without any splices.
2. Each cable shall be installed without intermediate termination points unless approved by Engineer in writing.

C. The total length of any horizontal station cable from the modular jack termination of the cable at the drop faceplate to the patch panel modular jack termination in its assigned TR shall not exceed ninety meters (90m) - two hundred ninety-five feet (295’) - unless approved by Engineer.

3.2 CEILING PANEL(S)

A. Ceiling panel(s) shall be removed as necessary for the cable installation and put back in place without damaging or soiling any of the panel(s) or supporting framework.

B. Ceiling panel(s) shall be handled so no fingerprints or marks are left on the panel(s), and the panel(s) are not damaged in any way.

C. The Contractor is responsible for the cost of repair or replacement of any panel(s) or ceiling panel(s) support/framework hardware that is damaged or soiled by the Contractor.

3.3 HORIZONTAL CABLE PLACEMENT

A. No cable shall run unsupported by conduit, cable tray, hangers, or other specified support for distances greater than five feet (5’).

B. No cable shall be attached to the suspended ceiling structure or laid directly on the ceiling tiles or hard lid as a means of support, and the bottom of a cable or cable bundle shall be minimum of six inches (6") above the ceiling tile grid.

C. No cable or cable bundle shall be supported by or attached by any means to fire sprinkler heads, delivery system hardware, environmental sensor system hardware, or the exterior of any conduit, ladder rack, or cable tray. Cable shall be supported by systems specifically installed for cable support.

D. Where cable being installed is not enclosed in conduit or cable tray, cross all electrical power circuit transport at right angles.

E. Where discontinuity of cable trays or conduit pathway occurs that causes cable or cable bundle to sag vertically three inches (3") or more, support the cable or cable bundle over the discontinuity using hangers, brackets, hooks, rings, and other applicable supporting devices specified.

F. During placement of cable runs, do not exceed manufacturer's maximum pulling tension or minimum bend radius limits.

G. Do not bundle cables in cable trays.

H. Do bundle two (2) or more cables with plenum-rated Velcro ties that are snug but which do not deform the cable geometry as follows:

1. Whenever cables in cable trays leave the cable tray and enter/exit distribution conduit.
2. Wherever cables enter a TR. Maintain bundling with the TR.

I. Manage slack to avoid excess cable or kinking.

J. Pull new pulling string through all conduits while placing new horizontal cable. Leave a pulling string in the utilized conduits for future use.

K. Do not roll or store cable reels without an appropriate underlay.

L. Cables with jackets that are chaffed, burned, have exposed internal conductor insulation, or have any bare copper (shiners) shall be replaced.

M. Maintain the following clearances from EMI sources:

1. Unshielded power lines or equipment less than or equal to 5 kVA near cable in open or non-metal pathway: twelve inches (12").
2. Unshielded power lines or equipment greater than 5 kVA near cable in open or non-metal pathway: twenty-four inches (24").
3. Unshielded power lines or equipment less than or equal to 5 kVA near cable in grounded metal pathway: six inches (6").
4. Unshielded power lines or equipment greater than 5 kVA near cable in grounded metal pathway: twelve inches (12").
5. Power lines enclosed in grounded metal conduit less than or equal to 5 kVA near cable in grounded metal pathway: three inches (3").
6. Power lines enclosed in grounded metal conduit greater than 5 kVA near cable in grounded metal pathway: six inches (6").
7. Fluorescent fixtures near cable in open or non-metal pathway: twelve inches (12").
8. Fluorescent fixtures near cable in grounded metal conduit: six inches (6").
9. Motors or transformers near cable in non-metal pathway: forty-eight inches (48").
10. Motors or transformers near cable in grounded metal pathway: thirty-six inches (36").

11. Radiating coaxial cabling: six inches (6”).

3.4 TERMINATION

A. Comply with Section 271119 - Communications Termination Blocks & Patch Panels and Section 271543 - Communications Faceplates and Connectors.

3.5 EXAMINATION

A. Comply with Section 270000 – Communications.

3.6 LABELING

A. Comply with Section 270000 – Communications.

B. Label placement: Attach a label to both ends of each cable six inches (6") from the cables termination at the drop and TR patch panel port.

C. All labels shall be machine created labels. Hand labeling is not acceptable.

3.7 TESTING

A. Comply with Section 271553 - Communications Cable Plant Testing.

3.8 AS-BUILT DRAWINGS

A. Comply with Section 270000 – Communications.

3.9 VERIFICATION

A. Comply with Section 270000 – Communications.

3.10 ADJUSTMENTS

A. Comply with Section 270000 – Communications.

3.11 ACCEPTANCE

A. Comply with Section 270000 – Communications.

END OF SECTION 271513

FOR BID ONLY

SECTION 271543
COMMUNICATIONS FACEPLATES AND CONNECTORS

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. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of new faceplates and proper termination of new connectors specified in this section of the Division 27 specifications and accompanying construction drawings.

B. Related Sections:

1. Section 270000 - Communications
2. Section 270600 - Communications Schedules
3. Section 271119 - Communications Termination Blocks and Patch Panels
4. Section 271513 - Communications Copper Horizontal Cabling
5. Section 271553 - Cable Plant Testing

1.3 QUALITY CONTROL

A. Comply with Section 270000 - Communications.

1.4 WARRANTIES

A. Comply with Section 270000 - Communications.

1.5 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.6 SUBMITTALS

A. Comply with Section 270000 - Communications.

1.7 COORDINATION

A. Comply with Section 270000 - Communications.

PART 2 - PRODUCTS

2.1 QUANTITY DETERMINATION

A. Comply with Section 270000 - Communications.

2.2 FACEPLATES

A. Provide all required faceplates - see Section 270600 - Schedules for Communications.

2.3 FACEPLATE LABELS

A. All labels shall be machine created labels, clearly legible, black letters on whitebackground.

2.4 CONNECTORS

A. Provide all required UTP data modular jacks - see Section 270600 - Schedules for Communications.

PART 3 - EXECUTION

3.1 GENERAL

A. For all cable types, connector installation execution shall comply with connector manufacturer's installation specifications, instructions, and recommendations.

3.2 EXAMINATION

A. Comply with Section 270000 – Communications.

3.3 FACEPLATE LABELING

A. Comply with Section 270000 – Communications.

B. Modular Jack Labels and Placements: Each drop faceplate modular jack position shall be labeled with its complete modular jack number which includes the Telecommunication Room (TR), patch panel, number, and the jack number.

3.4 TESTING

A. Comply with Section 271553 - Communications Cable Plant Testing.

3.5 AS-BUILT DRAWINGS

A. Comply with Section 270000 – Communications.

3.6 VERIFICATION

A. Comply with Section 270000 – Communications.

3.7 ADJUSTMENTS

A. Comply with Section 270000 – Communications.

3.8 3.07 ACCEPTANCE

A. Comply with Section 270000 – Communications.

END OF SECTION 271543

SECTION 271553
COMMUNICATIONS CABLE PLANT TESTING

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. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.
2. In addition to the tests detailed in this document, the contractor shall notify the Engineer of any additional tests that are deemed necessary to guarantee a fully functional system. The contractor shall carry out and record any additional measurement results at no additional charge.
3. This Section includes the minimum requirements for the test certification, identification and administration of backbone and horizontal optical fiber cabling.
4. This Section includes minimum requirements for:
   a. Fiber optic test instruments
   b. Fiber optic testing
   c. Identification
      1) Labels and labeling
   d. Administration
      1) Test results documentation
      2) As-built drawings

B. Related Sections:

1. Division 26 – Electrical
2. Section 270000 - Communications
3. Section 270600 - Schedules for Communications
4. Section 271100 - Communications Equipment Room Fittings
5. Section 271119 - Communications Termination Blocks and Patch Panels
6. Section 271300 - Communications Backbone Cabling
7. Section 271543 - Communications Faceplates and Connectors

1.3 QUALITY ASSURANCE

A. Comply with section 270000 - Communications.

B. Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

1. Manufacturer of the fiber optic cable and/or the fiber optic connectors.
2. Manufacturer of the test equipment used for the field certification.

C. The Owner shall be invited to witness and/or review field-testing.

1. The Owner and Engineer shall be notified of the start date of the testing phase five (5) business days before testing commences.
2. The Owner will select a random sample of 5% of the installed links. The Contractor shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor shall repeat 100% testing at no cost to Owner.

1.4 MATERIAL SUBSTITUTIONS

A. Comply with Section 270000 - Communications.

1.5 COORDINATION

A. In order to conform to the overall project event schedule, the cabling contractor shall survey the work areas and coordinate cabling testing with other applicable trades.

1.6 SUBMITTALS

A. Manufacturers catalog sheets and specifications for fiber optic field-test instruments including Certifying optical loss test sets (OLTS; power meter and source) and optical time domain reflectometer (OTDR).

B. A schedule (list) of all optical fibers to be tested.

C. Sample test reports

D. Comply with Section 270000 - Communications

1.7 ACCEPTANCE OF TEST RESULTS

A. Comply with Section 270000 - Communications

B. Each cabling link shall be in compliance with the following test limits:

1. Optical loss testing

a. Multimode and Single-mode links

1) The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA-568-C.0.

(i) Link Attenuation (dB) = Cable_Attn (dB) + Connector_Attn (dB) + Splice_Attn (dB)
(ii) Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)
(iii) Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
(iv) Maximum allowable connector_loss = 0.4 dB
(v) Splice_Attn (dB) = number_of_splices * splice_loss (dB)
(vi) Maximum allowable splice_loss = 0.05 dB
(vii) The values for the Attenuation_Coefficient (dB/km) are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

2. OTDR testing not required if fiber passes required optical loss testing.

a. Reflective events (connections) shall not exceed 0.4 dB.
b. Non-reflective events (splices) shall not exceed 0.05 dB.

C. All installed cabling links shall be field-tested and pass the test requirements and analysis as described in Part 3. Any link that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link meets performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with Part 3.

D. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

PART 2 - PRODUCTS

2.1 OPTICAL FIBER CABLE TESTERS

A. The field-test instrument shall be within the calibration period recommended by the manufacturer.

B. Certifying Optical loss test set (OLTS)

1. Multimode optical fiber light source

a. Provide dual LED light sources with central wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm)
b. Output power of –20 dBm minimum.
c. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause E.7 of ANSI/TIA-568-C.0) with a Category 1 light source.
d. Acceptable manufacturers

1) Fluke Networks DTX-8000 or Equal.

2. Single-mode optical fiber light source

a. Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1550 nm (±20 nm).
b. Output power of –10 dBm minimum.
c. Acceptable manufacturers

1) Fluke Networks DTX-8000 or equal

3. Power Meter

a. Provide 850 nm, 1300/1310 nm, and 1550 nm wavelength test capability.
b. Power measurement uncertainty of ± 0.25 dB.
c. Store reference power measurement.
d. Save at least 100 results in internal memory.
e. PC interface (serial or USB).
f. Acceptable manufacturers

1) Fluke Networks Fluke DTX-8000 or equal

4. Optional length measurement

a. An OLTS that is capable of measuring the optical length of the fiber shall be used.

C. Optical Time Domain Reflectometer (OTDR)

1. Multimode OTDR

a. Wavelengths of 850 nm (± 20 nm) and 1300 nm (± 20 nm).
b. Event dead zones of 3.7 m maximum at 850 nm and 1300 nm.
c. Attenuation dead zones of 10 m maximum at 850 nm and 13 m maximum at 1300 nm.
d. Distance range not less than 2000 m.
e. Dynamic range at least 10 dB at 850 nm and 1300 nm

2. Single-mode OTDR

a. Wavelengths of 1310 nm (± 20 nm) and 1550 nm (± 20 nm).
b. Event dead zones of 3.5 m maximum at 1310 nm and 1550 nm.
c. Attenuation dead zones of 10 m maximum at 1310 nm and 12 m maximum at 1550 nm.
d. Distance range not less than 10000 m.

e. Dynamic range at least 10 dB at 1310 nm and 1550 nm

3. Acceptable manufacturers

a. Fluke Networks or equal

2.2 ADMINISTRATION

A. Administration of the documentation shall include test results of each fiber link.

B. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

C. The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

PART 3 - EXECUTION

3.1 GENERAL

A. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.

B. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

C. Testing shall be carried out in accordance with this document. This includes testing the attenuation and polarity of the installed cable plant with a certifying optical loss test set (OLTS) and the testing of fiber splices, except for pigtail splicing, with an optical time domain reflectometer (OTDR).

D. Testing shall be performed on each cabling link (connector to connector).

E. All tests shall be documented including OLTS dual wavelength attenuation measurements for multimode and single-mode links and OTDR traces and event tables for multimode and single-mode links.

1. Documentation shall include optical length measurements.

3.2 OPTICAL FIBER CABLE TESTING

A. Field-test instruments shall have the latest software and firmware installed.

B. Link test results from the OLTS shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

C. Testing shall be performed on each cabling segment (connector to connector).

D. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for OLTS testing shall be between 1 m and 5 m in length.

E. Optical loss testing

1. Backbone link

a. Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or the equivalent method.
b. Single-mode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method.
c. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
d. Use the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1 or the equivalent method. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.
e. Each fiber link shall be tested in both directions.

F. Polarity Testing

1. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with Clause E.5.3 of ANSI/TIA-568-C.0. The polarity of the paired duplex fibers shall be verified using an OLTS.

3.3 TEST RESULTS DOCUMENTATION

A. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The file format, CSV (comma *separated value), does not provide adequate protection of these records and shall* not be used. PDFs shall not be used.

B. The test results documentation shall be available for inspection by the Owner and the Engineer during the installation period and shall be passed to the Engineer within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.

C. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD-ROM prior to the Engineer acceptance of the building. This CD-ROM shall include the software tools required to view, inspect, and print any selection of the test reports.

D. Circuit IDs reported by the test instrument should match the specified label ID.

E. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information

1. The identification of the customer site as specified by the end-user
2. The name of the test limit selected to execute the stored test results
3. The name of the personnel performing the test
4. The date and time the test results were saved in the memory of the tester
5. The manufacturer, model and serial number of the field-test instrument
6. The version of the test software and the version of the test limit database held within the test instrument
7. The fiber identification number
8. The length for each optical fiber
    a. The index of refraction used for length calculation when using a length capable OLTS
9. Test results to include OLTS attenuation link measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
10. The overall Pass/Fail evaluation of the link-under-test for OLTS measurements

END OF SECTION 271553

SECTION 274100
AUDIO VISUAL 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. Projector/Display Locations: An audio output from the projector/display will be extended to a user accessible wall plate for use with a portable assistive listening system.
2. Portable Assistive Listening System: A portable assistive listening system will be provided for each building. It will reside at the reception desk until requested for use by staff or students.
3. Provisioning of all labor, materials, equipment, accessories, services, and tests necessary to complete and make ready for operation, by the owner, the audiovisual system requirements for the space in accordance with this specification and the “E” series drawings.
4. Equipment to be provided includes
   a. Assistive Listening System
   b. Cabling
   c. Accessories (as required)
5. Notwithstanding the detailed information in this specification, it is the responsibility of the contractor for verifying the completeness of the parts list, the correctness of the type numbers, and to supply a fully working system meeting these specifications.
6. All items are to be furnished and installed by the audio-visual contractor with the following exceptions:
   a. All conduit, back boxes, and AC connections are shown elsewhere on electrical drawings.

1.3 SUBMITTALS

A. Pre-installation:

1. Equipment List: Submissions shall include a list of major equipment and a specification sheet for each major component that differs from those specified, showing it’s the satisfaction of specified requirements.
   a. The list of major equipment shall include; Manufacturer, Model, Quantity.
   b. Alternative equipment and methods will be reviewed; however, it is the responsibly of the contractor to demonstrate the alternate meets or exceeds the performance specified. Product details for any voluntary alternates or product substitutions.

2. Shop Drawings: Comprehensive wiring diagram showing all devices, cable types, connectors, and labels.

B. Post-installation:

1. Final Equipment List: Details on all equipment including: manufacturer, model, serial number, & warranty duration.
2. O&M Manual: Provide an electronic copy of all equipment specification sheets, owner's manuals.
3. As-Built Drawings: The contractor shall provide the Owner with as-built drawings reflecting the layout and labeled wiring diagrams of the completed system. Drawings to be submitted in PDF format.
4. Warranty Statement: Provide the terms and conditions of the one-year warranty covering all parts and labor starting upon system acceptance.

1.4 QUALITY ASSURANCE

A. Qualifications: To be considered technically qualified for this project, the contractor shall submit proof of the following:

1. A minimum of 5 years with professional audio video system integration.
2. A qualified project engineer on staff. Engineer shall be an InfoComm certified CTS-I. Provide the number of years of experience with professional video systems.

B. All equipment rooms shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Contract Documents shall be subject to the control and approval of the Owners representative. Equipment and materials shall be of the quality and manufacturer indicated. The equipment specified is based on the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to approval.

C. Materials and work specified herein shall comply with the applicable requirements of:

1. 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 the intended use.
2. Comply with CEC.
3. Comply with UL 50.

1.5 SUBSTITUTIONS

A. Substitutions: Substitutions will only be allowed by substitution requests submitted in accordance with Division 01 Section "Substitution Procedures" prior to the bid date.

1. In Part 2 Articles where manufacturers are listed for various product types and only one manufacturer is listed with no alternate manufacturers indicated, manufacturer listed is an established Owner standard and substitutions will not be allowed.

1.6 COORDINATION

A. Coordinate layout and installation of system components with other construction trades.

B. Coordinate the mounting requirements for AV equipment.

C. Prior to Installation:

1. Refer to Part 1 for all pre-installation submittal requirements.

1.7 WARRANTY

A. Provide a minimum 1-year parts and labor warranty on the system and wiring.

B. The warranty will not begin until the equipment has been tested and accepted by the owner.

C. Include in your submittal the duration and terms of the manufacturer's warranty.

D. Include in your submittal the duration and terms of your organization's warranty.

1.8 DEFINITIONS

A. OFOI – Owner Furnished, Owner Installed

B. OFCI – Owner Furnished, Contractor Installed

C. CFCI – Contractor Furnished, Contractor Installed

D. CFOI – Contractor Furnished, Owner Installed

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. General: Major equipment is specified in this section. Note the following:

1. Equipment shall have an equal or better performance to units described as "Basis of Design".
2. Minor material not specified below shall be of professional quality.
3. All cabling run through ceiling shall include a plenum rated jacket.

B. Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

C. Equipment: Modular type using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

2.2 XLR WALL PLATE

A. Single gang wall plate with 3-pole male XLR receptacle featuring brushed aluminum wall plate.

B. Basis of Design: Neutrik - 103M

2.3 ASSISTIVE LISTENING SYSTEM

A. 216 MHz RF system with (1) transmitter.

B. 216 MHz RF receivers, universal ear speakers, and neck loop lanyard

1. Quantity: 12

C. 4-port usb chargers to power each receiever.

1. Quantity: 3

D. Basis of Design: Listen Technologies - LS-53-216

2.4 ASSISTIVE LISTENING SYSTEM CASE

A. Configurable carrying case for assistive listening system devices with shoulder strap.

B. Basis of Design: Listen Technologies - LA-320

2.5 XLR CABLE, 20'

A. Basis of Design: Hosa – EBU-020

2.6 ASSISTIVE LISTENING RECEIVER

A. 216 MHz receiver with integrated DSP.

B. Basis of Design: Listen Technologies – LR-4200-216

2.7 UNIVERSAL EAR SPEAKER

A. High performance speaker that can be worn over either ear. Includes earphone extension cable.

B. Basis of Design: Listen Technologies – LA-401

2.8 NECK LOOP LANYARD

A. Neck loop with integrated induction loop driver.

B. Basis of Design: Listen Technologies – LA-430

2.9 4-PORT USB CHARGER

A. 4-port charger for rechargeable receivers.

B. Basis of Design: Listen Technologies – LA-423

2.10 90 DEGREE HELICAL ANTENNA

A. Compact 90-degree antenna for 216 MHz transmitter.

B. Basis of Design: Listen Technologies LA-124

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT:

A. Assistive Listening System:

1. Provide audio cable from projector/display to a user accessible location.
2. Test portable transmitter connection to each system being installed as part of this project.
3. Test all receivers and ensure operation.
4. Label transmitter and receivers with channel information.

3.2 LABELING AND IDENTIFICATION

A. Labeling requirements shall comply with INFOCOMM F501.01:2015 Cable Labeling for Audiovisual Systems.

B. Provide pre-printed labels at all faceplates and equipment clearly indicating connection and function.

C. Labels shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

D. All labels shall be preprinted or laser printed type.

E. All cables shall be labeled at both ends. Provide vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.

F. At project closeout provide as-built drawings showing all connections using the same labeling convention as installed system. See section 1.4C.3 for additional details.

3.3 TESTING AND COMMISSIONING

A. The commissioning process will be performed in conformance with ANSI/INFOCOMM 10:2013 – Audiovisual Systems Performance Verification. Verification reports will be issued at the end of the pre-integration, integration, post-integration, and closeout verification phases.

3.4 TRAINING

A. Instruction and training for operation and routing maintenance of the system shall be provided at the site, within twenty - five business days of final completion acceptance of the system, at a time mutually satisfactory to the contractor and owner.

B. Training shall include system(s) and circuit functional description and the proper adjustment procedure for every adjustment in the system.

C. The equipment will be made available by the owner, after delivery and acceptance, for use in the instruction and training program. The owner will provide space for instruction and training. The contractor shall provide the instructor(s) and all training material.

D. The instruction and training shall be scheduled not to exceed 7.5 hours each working day. Instructor(s) compensation, travel, living and all other expenses incurred as the result of fulfilling these requirements shall be the responsibility of the contractor.

3.5 PORTABLE ASSISTIVE LISTENING EQUIPMENT LIST

ID	DESCRIPTION	MANUF.	MODEL	SCOPE
EQ 2.01	RF Assistive Listening System w/ 4 Receivers	Listen Technologies	LS-53-216	CFCI
EQ 2.02	Portable Assistive Listening System case	Listen Technologies	LA-320	CFCI
EQ 2.03	20' XLRF to XLRM Cable	Hosa	EBU-020	CFCI
EQ 2.04	Intelligent DSP RF Receiver	Listen Technologies	LR-4200-216	CFCI
EQ 2.05	Universal Ear Speaker	Listen Technologies	LA-401	CFCI
EQ 2.06	Intelligent Earphone/Neck Loop Lanyard	Listen Technologies	LA-430	CFCI
EQ 2.07	4-Port USB Charger	Listen Technologies	LA-423	CFCI
EQ 2.08	90 Degree Helical Antenna	Listen Technologies	LA-124	CFCI

END OF SECTION 274100

SECTION 31100
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 1, General Requirements
2. Section 312000 – Earthwork: Excavation, Filling, and Grading
3. Section 312222 – Soil Materials
4. Section 312333 – Trench Excavation and Backfill

1.3 SUBMITTALS

(NOT APPLICABLE)

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. In accordance with Specification Section GENERAL REQUIREMENTS, 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].

B. Meetings:

1. Minimum agenda shall be to discuss coordination of upcoming work, review the work progress, discuss field observations, identification of any potential problems which may impede planned progress; corrective measures to regain projected schedule; and maintenance of quality and work standards.

2. Meetings shall include Pre-Clearing and Demolition Meetings.
3. Participants (or designated representative of) invited to attend each of the above meetings shall be as follows:

    a. Contractor.
    b. Owner.
    c. Architect.
    d. Testing Laboratory.
    e. Local Governing Authorities as applicable.
    f. Utility Representatives as applicable.
    g. Owner's Inspector.
    h. Clearing and Demolition Subcontractor.
    i. Other subcontractors, as appropriate (including any accessory subcontractors).

1.5 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

(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 or moved to a point at least 5 feet horizontally outside the proposed building and 3 feet horizontally outside the concrete flatwork or pavement construction areas. All resultant cavities must be backfilled with engineered fill.

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 Architect 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 312000
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 1, General Requirements
2. Section 311100 – Site Clearing
3. Section 312222 – Soil Materials
4. Section 312333 – 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. Geotechnical Engineering Investigation Report has been prepared for the project by BSK Associates; BSK Project No. G21-396-11F, dated January 21, 2022. A copy of the report is available (for reference only) at the cost of reproduction. Contact BSK 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.	CT	City of Tulare, 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 have 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.

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 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 exposed by the Contractor.

D. Determine exact location of existing buried utilities by:

1. Marking 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 Owner's personnel.

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 mild corrosive potential to buried concrete objects and high corrosive potential to buried unprotected 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 CT.

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 1, 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 SOIL MATERIALS.

B. Fill in Non-planting Areas: Type S1, S2 or S4 per Division 31 Specification Section SOIL MATERIALS.

C. Imported material: Type S3, S4 or S5 per Division 31 Specification Section 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.

3.3 SITE STRIPPING:

A. Reference is made to Division 31 Specification Section 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, excavate planned construction areas as specified in this Section.

B. Within the area of the planned building improvements plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 24 inches below the stripped subgrade surface or at least 12 inches below proposed foundations, whichever is lower.

C. Provide additional excavation as required to conform to the lines, grades and cross-sections shown on the plans.

D. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw. Remove all roots 1/2” in diameter and greater.

E. 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.

F. Areas disturbed by demolition must be excavated to expose undisturbed soils.

G. Excavated soils 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.

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 or above optimum moisture content, and compact to a minimum of 90% of maximum dry density 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 1.9.H.

E. On-site 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 at or above of optimum moisture, placed in uncompacted layers not exceeding eight (8) 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.
   2. Vegetative surface improvement areas (turf and planters) - Below top twelve (12) inches - to a minimum of 90% of maximum dry density. Top twelve (12) inches - 85% of maximum dry density.
   3. Pavement areas: to a minimum 95% of maximum dry density 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 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 1, 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 312222
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:
   1. Section 312000 - Earthwork: Excavation, Filling and Grading
   2. Section 312333 - 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 re-used material, graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Soil Type S2: Excavated and reused material, graded; free of 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: 3”
2. Plasticity Index: <12
3. Percent Passing #4 Sieve: 65-100
4. Percent Passing #200 Sieve: 20-45
5. Expansion Index: <20
6. Low Corrosion Potential:

   a. Soluble Sulfates: <1,500 mg/Kg
   b. Soluble Chlorides: <300 mg/Kg
   c. Soil Resistivity: >2,000 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.

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 BSK Associates Engineers and Laboratories, Project number G21-396-11F, dated January 31, 2022.

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 1, General Requirements.
2. Section 311100 - Site Clearing
3. Section 312000 - Earthwork: Excavation, Filling and Grading
4. Section 312222 - Soil Materials
5. Section 331200 - Water Utilities
6. Section 334000 - 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 used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB] and the Environmental Protection Agency [EPA].
b.	CT	City of Tulare, 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.

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 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 exposed by the Contractor.

C. Determine exact location of existing buried utilities by:

   1. Marking 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 (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. 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 Owner's personnel.

E. Provide Field Engineering per Contract General Conditions and Division 1 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 45 degree 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, S4 or S5 material, thoroughly compacted. 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, S4 or S5 material containing sufficient moisture to allow compaction to 90% maximum dry density. 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% of the maximum dry density.

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 uncompacted thickness, moisture condition to at least 2% above optimum moisture content.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

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.

J. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 90% maximum dry density.

K. In areas to receive asphalt concrete pavements, compact the top 12-inches to 95% maximum dry density.

L. In planting areas, compact the top 12-inches to 85% maximum dry density.

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 1.

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

FOR BID ONLY

SECTION 32 01 90
EXISTING LANDSCAPE PROTECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes but is not limited to the following:
   1. Protection and maintenance of existing trees and other plants that are affected by the execution of the Work, whether temporary or new construction.

B. Related Work Specified Elsewhere
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections.
   2. Section 31 11 00: Site Clearing
   3. Section 31 20 00: Earthwork
   4. Section 31 23 33: Trench Excavation and Backfill
   5. Section 32 84 00: Irrigation System
   6. Section 32 90 00: Landscape Planting

1.2 SUBMITTALS

A. Product Data: For each type of product indicated or proposed for use.

B. Qualification Data: Submit arborist's certification and/or license information. Submit qualifications and experience of the certified tree worker if not the arborist.

C. Project Certification: Provide a certification letter from the consulting arborist that trees indicated to remain have had their Tree Protection Zone (TPZ) protected during construction according to these specifications and/or the arborist's recommendations. Provide a list of any trees damaged during construction and the subsequent treatment and repair.

D. Transplanting and Maintenance Recommendations: Submit transplanting, maintenance and protection specifications from a qualified arborist for care and protection of trees during and after completion of the Work that are likely to be affected by construction operations. The tree maintenance recommendations shall be included in the Maintenance Manuals required in 329000.

E. Tree Assessment and Valuation: Prior to the start of any construction operations of any kind, submit a tree assessment including tree valuation for existing trees scheduled to remain in the area of work or in auxiliary construction areas.
   1. Tree valuation for trees species that do not have comparable and available replacement sizes shall be determined by a certified consulting arborist experienced in tree valuation using the "Guide for Establishing Values of Trees and Other Plants", current edition, published by the International Society of Arboriculture, Urbana, Illinois.
   2. Tree assessment shall include a physical description, health, condition and recommended pruning and/or mitigation measures based on the expected construction operations to minimize the negative impacts to the affected trees.

1.3 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and/or relocation work similar to that required for this Project, and who will provide experienced, certified tree workers.

B. Arborist Qualifications: The arborist shall be certified by the International Society of Arboriculture. If the arborist is performing tree work, he/she shall be employed by a licensed contractor, or shall hold an individual license if independent.

C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated or recommended by the certified arborist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: See Section 32 93 00.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers, minimum 4.8 oz/sq. yd.

D. Temporary Fencing at the TPZ: Heavy-duty exterior rated plastic or chain link fencing, minimum four feet high with stakes at a maximum 10 feet on-center or as needed for a taut installation.

E. Wood mulch: Walk-on type chipped wood and aged greenwaste material without leaves, green wood, sticks, dirt, dust, construction materials and other debris. Particle size 1/2” to 3" in general size.

F. Coarse sand: Clean sand with greater than 95% passing a #10 seive, less than 5% passing a #30 seive, and less than 1% passing a #50 seive.

2.2 TEMPORARY TPZ FENCING TYPES

A. TPZ 1: Temporary fencing shall be installed at the drip line of the tree canopy. Where the canopy extends into remaining or proposed hardscaped areas, the posts may be supported by appropriate on-grade concrete or weighted bases.

B. TPZ 2: Where existing trees are in planting strips with active walkways and/or roadways in the TPZ, the temporary fencing shall extend to the edge of the hardscaped areas to keep the walkways and/or roadways open.

C. TPZ 3: Existing trees remaining in small planters or tree wells shall be wrapped with a minimum 2 inch thickness of orange plastic construction fencing from the ground to the first scaffold branch, or 4 feet high, whichever is greater. The wrapped section shall be covered with vertical 1.5 inch square slats and bound around the trunk firmly at least every 2 feet. Use caution when installing the slats so that the tree bark is not damaged.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing located around the canopy drip line of trees (the tree protection zone [TPZ]), and around the plants scheduled to remain that are inside the construction area. The TPZ fence layout shall be reviewed for acceptance by the Owners Representative and the consulting arborist.

B. All work within the TPZ shall be reviewed and monitored by the consulting arborist.

C. Within the TPZ, install a 4 inch depth of wood mulch over a permeable filter fabric with minimum 4 inch overlaps at fabric seams. Remove the protection mulch and fabric prior to any cultivation and amendment tillage.

D. Provide a temporary dirt berm watering basin around trees and plants scheduled to remain. The berm around trees shall be a minimum diameter of six times (6x) the diameter of the tree at breast height (DBH), or not less than six feet in diameter, whichever is greater.

E. Provide temporary irrigation or a portable water source to irrigate trees and plants scheduled to remain. Irrigate at minimum once a week or more often as necessary to moisten soil to a minimum 18 inch depth for trees, and a minimum depth of 12 inches for shrubs. Reapply irrigation based on an evapotranspiration loss of 50%.

F. Protect plant/tree root systems within the protected fenced areas from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

G. Do not store construction materials, debris, or excavated material within the TPZ. Do not permit vehicles or reoccuring foot traffic within the TPZ to prevent soil compaction over root systems.

H. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

A. Do not excavate within the canopy drip line of existing trees unless otherwise authorized. Any excavation within the TPZ shall be performed under the onsite monitoring by the consulting arborist.

B. Where excavation for new construction and/or utility lines are required within the canopy drip line of trees, hand clear and excavate to minimize damage to root systems. Use spading forks to comb soil or use an Air-Spade to expose roots.

C. Where utility lines are to be located within the drip line of trees, expose the existing root system to the depth of utility line installation plus the depth of any required bedding material. Place piping below and/or through the exposed roots without damage to the root system. Backfill with approved material and compact by flooding the area if allowed.

D. As an alternative to manual or Air-Spade trench excavation, utility or other below grade piping may be mechanically bored under the crown dripline with a minimum cover of 3 feet as authorized by the consulting arborist.

E. Root Pruning: Do not cut main lateral roots or taproots greater than one inch in diameter. Smaller roots less than one inch in diameter that interferes with the installation of new improvements and/or utility lines may be cut only if absolutely necessary. Only cut roots with sharp pruning instruments; do not break, tear or chop. Block out concrete footings around roots greater than one inch diameter leaving a minimum one inch clearance around roots to remain. Provide alternative footing design if main lateral roots are in conflict.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by the certified arborist, unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots less than one inch diameter. Cut roots with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 12 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations. Do not place fill greater than 6 inches in depth within 24 inches of the trunk, and do not cover the trunk/root base flare. Do not allow standing water at the trunk.

C. Moderate Fill: Where existing grade is more than 12 inches , but less than 18 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
   1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of existing grade and extend not less than 20 inches from tree trunk on all sides up to the finish grade. Slope of the rock fill shall be a maximum 2h:1v. For balance of area within drip-line perimeter, place drainage fill a minimum 6 inches in depth.
   2. Place filter fabric over the drainage fill with edges overlapping 6 inches minimum.
   3. Place fill layer of topsoil to finish grade. Do not mechanically compact drainage fill or topsoil more than 85% relative density in planted areas. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune remaining trees affected by temporary and new construction only when authorized by the Landscape Architect and as recommended by the consulting arborist.

B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system only when authorized by the Landscape Architect and as recommended by the consulting arborist. Provide subsequent maintenance during Contract period as recommended by the consulting arborist.

C. Pruning Standards: Prune trees according to ANSI A300 based on pruning for access clearance, to correct any defects in structure, or to remove potential conflicts with new improvements. Pruning shall only be performed by a Certified arborist or tree worker.

D. Cut branches with sharp pruning instruments; do not break or chop. Clean pruning tools with a diluted bleach solution prior to performing any pruning operations.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the arborist.

B. Remove and replace dead and/or damaged trees impacted by the construction operations that the arborist determines to be incapable of restoring to a normal growth pattern.
   1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in 32 90 00.

2. When new trees of the same size and species are not available, furnish and install the largest size boxed tree that is readily available and will successfully grow in the planting area with long term health and without damage to adjacent improvements. Credit the Owner the difference between the valuation of the removed existing tree and the installed replacement tree.

C. Aerate surface soil within any existing Oak tree dripline compacted before or during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 18 inches deep at 36 inches o.c. Backfill holes with coarse sand. Manually till the top 4 inches with a spading fork, and break up clods greater than 1 inch diameter. Smooth grade prior to installing wood mulch.

3.6 CLEAN-UP

A. Burning is not permitted. Legally dispose of debris.

B. Prior to Final Acceptance, remove the TPZ fence, stakes and other related materials.

C. Legally remove excess excavated material, debris, displaced trees, and greenwaste from Owner's property. Broom clean all hardscape surfaces in the area of work.

END OF SECTION

FOR BID ONLY

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-1 Specification sections, apply to the work specified in this section.

1.2 SECTION INCLUDES

A. Furnish and install soil sterilant under 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-1 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.
CC	City of Tulare

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.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under Specification Section QUALITY REQUIREMENTS.

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 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 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 thicker than one inch. 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 insure 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

FOR BID ONLY

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-1 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. Integral color sample, where applicable.

5. Application instructions for the architectural finish materials.
6. 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
      4) Cement Content: 5.5 sacks/yd minimum
      5) Max Water/Cement Ratio: Per SSCDOT
      6) Admixture Per SSCDOT
   b. Structures & Vehicular Concrete Paving: Use for site structures 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
      4) Cement Content: 6.5 sacks/yd minimum
      5) Max Water/Cement Ratio: Per SSCDOT
      6) Admixture: Per SSCDOT
   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
      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

FOR BID ONLY

SECTION 32 13 15
CONCRETE REINFORCEMENT

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. Deformed reinforcing bars for site concrete improvements.

B. RELATED SECTIONS
   1. Section 32 13 13 - Site Concrete Improvements.

1.3 SUBMITTALS

A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.

   1. Mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered. If mill test reports are not available and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove yield strength and bending.
   2. Drawings and placing diagrams for each grade slab including dowels and corner bars.
   3. On the placing diagrams, show all openings for pipelines and architectural features. Include additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings.
   4. Coordinate placing diagrams with the concrete placing schedule.

1.4 PRODUCT DELIVERY

A. Deliver reinforcement to project site in bundles marked with tags indicating bar size and length.

B. Store on wooden supports above ground surface.

PART 2 - PRODUCTS

2.1 BARS

A. Bars shall be deformed billet steel conforming to ASTM A 615, Grade 60. Mixing of steel grades will not be allowed.

2.2 BAR SUPPORTS

A. Bar support shall be concrete or metal chairs, spacers or hangers. Reinforcing bars shall not be supported by forms.

2.3 TIE WIRE

A. Tie wire shall be annealed steel wire of not less than 16-gauge.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Position reinforcement in accordance with the drawings, secure with wire ties or suitable clips at all intersections, and support by an adequate number of concrete or metal chairs, spacers, or metal hangers such that reinforcing bars do not sag more than one quarter of an inch (1/4”) between supports. Do not place reinforcement or supports in contact with the forms. Bend tie wires away from the forms in order to provide the specified concrete coverage. To secure reinforcement in position, the Contractor may elect to locate bars additional to those shown on the drawings, but at no additional cost to the Owner.

B. Set reinforcing dowels and anchor bolts in place prior to placing concrete. Do not press them into the concrete after the concrete has been placed.

3.2 SPLICES

A. Splice bars only at locations shown on the drawings. Where splices are not detailed, lap bars 72 bar diameters.

3.3 CLEANING

A. Remove dirt, form oil, excessive rust, cement coating from previous pours, and foreign matter that will reduce bond with concrete.

3.4 PROTECTION DURING CONCRETING

A. Keep reinforcing steel in proper position during concrete placement.

END OF SECTION

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Furnish and paint parking stalls, traffic markings, wording, accessible markings and hatching on asphalt-concrete surfaces.

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-1 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 1.

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, disabled symbol 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 1.

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 2.1 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 1.

END OF SECTION

FOR BID ONLY

SECTION 32 28 52
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-1 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 323111
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. Section Includes:

1. Gate operators for swing gates.
2. Controls for gate operators.

B. Related Requirements:

1. Division 03 Section “Post Installed Concrete Anchors” for post installed concrete anchors.
2. Division 03 Section “Cast-in-Place Concrete” for concrete bases for gate operators and equipment.
3. Division 05 Section “Metal Fabrications” for custom metal framed gates.
4. Division 26 through 28 Sections as applicable for power distribution and security access control systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of gate operator.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review coordination of automatic detection loops in pavement.

1.4 ACTION 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.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in operation and maintenance manuals.

1.7 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 GATE OPERATORS

A. Operators: Factory-assembled, automatic, gate-operating 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 adjustment 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 NFPA 70, 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. Gate Operators: Equipment base/pad mounted and as follows:

1. Basis of Design: Design, Drawings and Specifications are based on the following:

a. LiftMaster; Model CSW200UL swing gate operator

1) Subject to compliance with requirements, provide product specified or submit request for substitution per Division 01 Section “Substitution Procedures.”

2. Duty: Heavy duty commercial.
3. Motor: 1 HP AC motor.
4. Voltage:

a. Motor: 120VAC single phase.
b. Controls and Accessories: 24 V DC.

5. Gate Speed: open to 90 degrees in 20 seconds.
6. Maximum Gate Weight: 2,000 lbs.
7. Frequency of Use: Continuous duty.
8. Operating Type: Crank arm.
9. Drive Type: Enclosed worm gear reducer drive in synthetic oil bath.

F. Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA 250, Type 3R enclosure for surface mounting and with space for additional optional equipment.

G. Control Devices:

1. Digital keypad with electronic security key.

   a. Basis of Design: Design, Drawings, and Specifications are based on the following:

      1) CyberLock; CyberKey Authorizer Keyport 2.

         a) Refer to Electrical Drawings for additional information.

2. Vehicle Loop Detector: System that includes automatic closing timer with adjustable time delay before closing and loop detector designed to hold gate open until traffic clears. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, and as recommended in writing by detection system manufacturer for function indicated.

   a. Loop: Field-assembled or factory-preformed wire for pave-over or saw-cut and epoxy-grouted installation.

3. Vehicle Presence Detector: System that includes automatic closing timer with adjustable time delay before closing and presence detector designed hold gate open until traffic clears.

   a. Provide retroreflective detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.

H. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:

1. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.

   a. Along entire gate leaf leading edge.

I. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully open and fully closed positions.

J. Emergency Release Mechanism: Quick-disconnect release of operator drive system, permitting manual operation if operator fails. Control circuit power is disconnected during manual operation.

1. Type: Mechanical device, key, or crank-activated release.

K. Operating Features:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features. Provide unit that is isolated from voltage spikes and surges.
2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
4. Automatic Closing Timer: With adjustable time delay before closing.
5. Open Override Circuit: Designed to override closing commands.
6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
8. Clock Timer: 24 hour, Seven day period, programmable for regular events.

L. Accessories:

1. Warning Module: Audio/visual strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.

   a. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.

3. External electric-powered magnetic lock with delay timer allowing time for lock to release before gate operates.
4. Instructional, Safety, and Warning Labels and Signs: According to UL 325 and Manufacturer's standard for components and features specified.
5. Equipment Bases/Pads: Cast-in-place or precast concrete, depth not less than 12 inches below grade, dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.

2.2 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

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 installation 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 locations according to gate-operator component manufacturer's written instructions and as indicated.

C. Vehicle Loop Detector System: Cut grooves 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 NFPA 70 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, distortion, nonalignment, misplacement, disruption, 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 323113
CHAIN LINK FENCES AND GATES

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. Chain-link fences.
2. Swing gates.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, gate hardware, and finishes for chain-link fences and gates.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

1.4 QUALITY ASSURANCE

A. Accessible Gates: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1, and the California Building Code.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide chain link fence fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Wire diameter: 0.148 inches (9 gage).
3. Mesh Size: 2 inches.
4. Zinc-Coating: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
5. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Heavy industrial strength round steel pipe, material Group IA, schedule 40, galvanized; pipe coated inside and outside by hot-dipped method, 1.8 oz. per square foot of surface; provide members with minimum dimensions and wall thickness according to ASTM F 1083 based on the following:

1. Fence Height: As indicated on Drawings.
2. Line Posts:

    a. Fence height to 6 feet: 1.9 inches outside diameter, 2.72 plf.
    b. Fence height over 6 feet to 8 feet: 2.375 inches outside diameter, 3.65 plf.

3. End, Corner and Pull Posts:

    a. Fence height to 6 feet: 2.375 inches outside diameter, 3.65 plf.
    b. Fence height over 6 feet to 8 feet: 2.875 inches outside diameter, 5.79 plf.

4. Gate Posts: Posts for individual gate leaf widths as follows:

    a. Gate leaf width to 6 feet: 2.875 inches outside diameter, 5.79 plf.
    b. Gate leaf width over 6 feet to 12 feet: 4.0 inch outside diameter, 9.11 plf.

5. Horizontal and Brace Rails: 1.66 inches outside diameter, 2.27 plf.

2.3 TENSION WIRE

A. Tension Wire: 0.177-inch diameter, marcelled steel tension wire complying with ASTM A 817 and ASTM A 824; Type II, zinc coated (galvanized), Class 4, not less than 1.2 oz./sq. ft. of uncoated wire surface.

2.4 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and swing gate types.

1. Gate Height: Match fence height.
2. Gate Leaf Width: As indicated on Drawings.

    a. Pedestrian gates shall provide not less than 32 inches in clear width with the gate in a 90 degree open position.
    b. Fire department vehicle access gates shall provide not less than 20 feet in clear width with the gates in a 90 degree open position.

B. Gate Framing: Steel pipe matching fence framing and as follows:

1. Gate leaf width up to 6 feet, perimeter framing: 1.90 inches outside diameter, 2.72 plf.
2. Gate leaf width over 6 feet to 12 feet, perimeter framing: 2.375 inches outside diameter, 3.65 plf.
3. Intermediate Framing and Bracing: 1.90 inches outside diameter, 2.72 plf.

C. Gate Construction:

1. Corner Construction: Assemble gates with corner fittings.
2. Bracing: Provide adjustable truss rod bracing for all gates and between intermediate framing members for gate leaves over 8 feet in width.
3. Intermediate Framing: Provide intermediate vertical framing for gates exceeding 8 feet in width; equally space intermediate framing and space not more than 8 feet on center.
4. Kick Plates for Gates 4 Feet in Width or Less: Provide 1/8 inch thick by 10 inch high galvanized steel plates at the bottom of each side of gates to provide a smooth and unobstructed surface for persons in a wheel chair. Kick plates shall be without sharp edges or corners. Plates shall not interfere with the ability to adjust truss rod bracing.

D. Gate Hardware:

1. Hinges: 180-degree swing in direction indicated on Drawings.
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

    a. Lever handle operating hardware: Gates 4 feet in width or less shall have lever handled hardware that does not require pinching, grasping, or twisting to operate.

3. Double Gates: The inactive leaf of double gates shall be provided with a drop rod and be capable of being locked with a padlock.
4. Gate Stops: Provide gates stops for each leaf of double gates.
5. Gate Keepers: Provide gate keepers for each gate leaf 5 feet or more in width.

2.5 FITTINGS

A. Fittings, General: Comply with ASTM F 626.

B. Post Caps: Caps shall be weatherproof to prevent moisture intrusion into posts. Provide line post caps with loop to receive top rail; provide for each post.

C. Rail and Brace Ends: Designed to provide secure connection of top rails to terminal post and brace or other rails to terminal and intermediate posts; provide for each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel for posts up to 4 inches in outside diameter.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment; minimum 5/16 inch rod diameter.

H. Tie-Wire: Standard round wire ties for attaching chain-link fabric to posts, rails, and frames; hot-dip galvanized steel, 0.148-inch (9 gage) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Hog Rings: Round wire ties for attaching chain-link fabric to bottom tension wire; 0.12-inch diameter of same material and finish as fabric wire.

J. Finish: Metallic coating for pressed steel or cast iron fittings, not less than 1.2 oz. /sq. ft. zinc.

2.6 SETTING MATERIALS

A. Cementitious Material: Portland cement, ASTM C 150, Type II, gray.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. Proportion normal-weight concrete mixture as indicated below for strength, slump, water/cement ratio, and maximum aggregate size.

1. Strength: 3000 psi at 28 days.
2. Aggregate Size: 1-1/2 inch maximum.
3. Slump: 4 inches.
4. Water Cement Ratio: 0.53 Maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 FENCE FRAMING INSTALLATION

A. Post Excavation and Footings: Drill or hand-excavate holes for posts to diameters, depths, and spacings indicated, in firm, undisturbed soil; if footing diameters and depths are not indicated, footings shall be as follows:

1. Tops of footings shall be established as 4 inches below finish grade.
2. Fences to 6 Feet in Height:

   a. Line Posts: 10 inches diameter by 30 inches deep.
   b. End, Corner, and Pull Posts: 10 inches diameter by 36 inches deep.
   c. Gate Posts, Leaves to 6 Feet Wide: 12 inches diameter by 42 inches deep.
   d. Gate Posts, Leaves over 6 Feet to 12 Feet Wide: 16 inches diameter by 48 inches deep.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

   a. Comply with the following for posts in paved areas installed prior to paving:

      1) Posts in Concrete Paved Areas, Curbs, and Mow Strips: Coordinate top of paving elevation and pour concrete fill to approximately 6 inches below finish grade.
      2) Posts in Asphalt Concrete Paved areas: Concrete fill to be flush with adjacent paving and crowned to shed water away from posts. Coordinate top of paving elevation and form top 6 inches of footing with round concrete form of diameter matching post footing; pour concrete fill prior to paving operations.

   b. Posts in Unpaved Areas: Concrete fill to be 2 inches above finish grade and crowned to shed water away from posts. Coordinate finish grade elevation and form top 6 inches of footing with round concrete form of diameter matching post footing.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at 10 feet o.c. unless otherwise indicated.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

   1. Locate horizontal braces at midheight of fabric 6 feet or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Where indicated or required, install and secure to posts with fittings.

H. Bottom Tension Wire: Install according to ASTM F 567 extended along and within 6 inches of bottom of fabric maintaining plumb position and alignment of fencing. Pull wire taut, without sags; install tension wire before stretching fabric; tie to each post with not less than same diameter and type of wire.

3.5 CHAIN-LINK FABRIC INSTALLATION

A. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

B. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

C. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing. Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

D. Fasten fabric to tension wire with hog rings spaced a maximum of 24 inches o.c.

E. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.6 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION

SECTION 323119
DECORATIVE METAL FENCES AND GATES

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. Decorative metal fences and gates (shop fabricated).

B. Related Requirements:

1. Division 03 Section “Cast-in-Place Concrete” for concrete for setting fence posts.
2. Division 05 Section "Metal Fabrications" for metal fabrications not included in this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Include plans, elevations, component details, and attachments to other work. Indicate materials and profiles of each metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Fabricator of products.

C. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal fencing and gates in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal fencing and gates by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements for Gates and Hardware: Pedestrian gates and hardware indicated to be accessible shall comply with accessibility requirements of the 2010 ADA Standards for Accessible Design and the 2019 California Building Code, Chapters 10 and 11B.

1. Gates shall be capable of opening a minimum of 90 degrees.
2. Gates in the open position shall provide a clear opening width of not less than 32 inches.
3. The bottom 10 inches of the push side of gates shall have a smooth uninterrupted surface that allows the door to be opened by a wheel chair footrest without creating a trap or hazardous condition.
4. The effort to open gates shall not exceed a 5 pound force applied perpendicular to the face of the gate.
5. Gates shall be openable from the secure side (inside) without the use of a key or special knowledge or effort. Operating hardware shall not require pinching or grasping to operate hardware.

a. Gates may be designed for key operation from either or both sides when gates are not required egress gates as determined by the Architect and the Division of the State Architect.

2.2 STEEL AND IRON MATERIALS

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Tubing: ASTM A 500/A 500M (cold formed).

C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M unless otherwise indicated.

F. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.

2.3 FASTENERS

A. Fastener Materials: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating or Type 304 stainless steel.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Post-Installed Anchors: Mechanical fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

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

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

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

2.5 SETTING MATERIALS

A. Cementitious Material: Portland cement, ASTM C 150, Type II, gray.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. Proportion normal-weight concrete mixture as indicated below for strength, slump, water/cement ratio, and maximum aggregate size.

1. Strength: 3000 psi at 28 days.
2. Aggregate Size: 1-1/2 inch maximum.
3. Slump: 4 inches.
4. Water Cement Ratio: 0.53 Maximum.

2.6 FABRICATION, GENERAL

A. Fabricate fence panels in sections to prevent the need for field welding or cutting. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

1. Components of fabricated items shall not be finished until after fabrication.

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

C. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

D. Provide necessary brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

E. Connect members with full-penetration welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

2.7 DECORATIVE METAL FENCING

A. General: Fabricate decorative metal fencing from steel bars and shapes of sizes and profiles indicated.

1. Fabricate fence panels in sections to facilitate galvanizing, transportation to the Project Site, and installation.

B. Fence Height: As indicated on Drawings.

C. Posts, Rails, and Pickets: Square steel tube sections complying with ASTM A-500 with hot dipped galvanized exterior zinc coating and as follows:

1. Posts: Posts having a minimum yield strength of 45,000 psi and a minimum size as follows:

a. Posts for Fences: 4 inches square x 1/8 inch thickness.

1) Spacing: Nominal 8 feet on center maximum; posts shall be equally spaced on a standard module.

b. Posts for Swing Gates: Size as follows:

1) Gates to 48 inches Wide: 4 inches square x 1/8 inch wall thickness.
2) Gates over 48 inches Wide to 96 inches Wide: 6 inches square x 1/4 inch thickness.
3) Gates over 96 inches wide to 144 inches Wide: 6 inches square x 3/8 inch thickness.

2. Horizontal Rails: 2 inches square x 11 gage (0.120 inch).

3. Pickets: 1 inch square x 14 gage (0.080 inch).

a. Spacing: Nominal 6 inches on center nominal.

D. Finish: Galvanize and powder coat after fabrication.

2.8 SWING GATES

A. General: Fabricate decorative metal swing gates from steel bars and shapes of sizes and profiles indicated in Drawings, match characteristics of fence design.

1. Pedestrian gates shall comply with accessibility and hardware requirements indicated in Part 2 “Performance Requirements” Article.

B. Gate Height: Match adjacent fence panels.

C. Gate Width: As indicated on Drawings; 32 inches minimum clear width when gate is in a 90 degree open position.

D. Gate Framing: Hollow tubular steel sections of size, wall thickness, and spacing as indicated on Drawings, not less than 2 inches x 2 inches x 11 gauge (0.120 inch) minimum size).

E. Rails: Match fence rails.

F. Pickets: Match fence pickets.

G. Hinges: Butt hinges or pivots as selected by fabricator; hinges to be sized for not less than twice the weight of the gate and allow the gate to open 180 degrees.

H. Operating Hardware: Gates shall be prepared to receive a cylinder lock, mortise lock, or exit device as indicated on the drawings.

I. Finish: Galvanize and powder coat after fabrication.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M. Galvanize items after fabrication.

1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Powder-Coat Finish for Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 2 mils.
4. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal fences and gates.

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

3.2 INSTALLATION

A. Provide anchorage devices and fasteners where needed to secure decorative metal fencing to in-place construction.

B. Set posts accurately in location, alignment, and elevation; measured from established lines and levels.

1. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil. Footings shall have a diameter not less than 4 times the width of posts and shall extend 6 inches below the bottom of the post.
2. Post Setting: Set posts in concrete into firm, undisturbed soil. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices. Crown top of exposed concrete to drain water away from posts. Protect aboveground portion of posts from concrete splatter.

C. Install gates level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.

D. Perform cutting, drilling, and fitting required to install decorative metal fencing. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

F. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

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

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING

A. 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.

3.4 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

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

   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

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

D. Protect finishes from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

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

END OF SECTION

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

FOR BID ONLY

SECTION 323313
BICYCLE RACKS

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. Bicycle racks of bent steel tubing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including assembly and installation instructions.

B. Shop Drawings: Show fabrication and installation details for site furnishings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store site furnishings in manufacture's unopened packaging until ready for installation and protected from weather, moisture, soiling, abrasion, and humidity.

1.5 COORDINATION

A. Coordinate installation of anchorages for bike racks. 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. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 BICYCLE RACKS

A. Basis of Design: Drawings and specifications are based on the following:

1. Belson Oudoors; Model BRBC-6 bicycle rack.

   a. Subject to compliance with requirements, provide product indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”

B. Description: Coiling style, bent steel pipe bicycle rack as follows:

1. Material: Galvanized steel tubing, 1.9 inch outside diameter by 0.095 inch wall thickness.
2. Bicycle Capacity: 6 bicycles.
3. Length: 46 inches nominal.
4. Height: 32 inches nominal (Installed height).
5. Finish: Gloss polyester powder coat.

   a. Color: As selected by Architect from manufacturer’s standard colors.

6. Anchorage Method: In-ground (embedded).

   a. Belson; Model BC-IGM in-ground mounting kit.

2.2 FERROUS METALS

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

B. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide tamper-resistant screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion type or chemical type and as indicated on Drawings.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 FABRICATION, GENERAL

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

B. Fabricate bends in pipe by hydraulic bending with a mandrel.

C. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

2.5 STEEL FINISHES

A. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

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

3.2 INSTALLATION, GENERAL

A. Install bicycle racks in accordance with manufacturer’s written installation instructions and as indicated on Drawings.

B. Provide anchorage devices and fasteners where needed to secure site furnishings to in-place construction.

C. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

3.3 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Protect finishes from damage during construction period with temporary protective coverings. Remove protective covering at time of Substantial Completion.

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

END OF SECTION

SECTION 323314
BICYCLE LOCKERS

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. Bicycle lockers.

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.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For units requiring color selection.

D. Maintenance Data: For bicycle lockers to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 BICYCLE STORAGE LOCKERS

A. Basis-of-Design Product: Drawings and Specifications are based on the following:

1. CycleSafe® Inc., Standard Model (SM) ProPark® Bicycle Storage Locker.

a. Subject to compliance with requirements, provide product indicated or a comparable product subject to request for substitution per Division 01 Section “Substitution Procedures.

B. Description: Ground mounted, molded fiberglass reinforced plastic bicycle lockers designed for interlocking multiple units and anchored to concrete slabs on grade.

1. Configuration: Double sided units, parallel sides with angled interior divider, two doors per unit with doors at opposite ends. Each unit provides two bicycle compartments of approximately 31 inches wide at the front (door end), 6 inches wide at the back, 72 inches deep, and 40 inches high.
2. Unit Size: 3 feet wide by 6 feet 6 inches deep by 4 feet 2 inches high nominal.
3. Number of Units: As indicated on Drawings.
4. Framing: Hot compression molded fiberglass reinforced plastic using polyester resin, reinforced framing with molded-in concealed fasteners at fastening points.
5. Exposed Door and Top Panels: Hot compression molded fiberglass reinforced plastic using polyester resin with internal reinforcing ribs and stiffened edges.
6. Exposed Side Panels: Manufacturer's standard fiberglass reinforced plastic panel.
7. Interior Divider Panels: Oriented strand board, exterior type, or equivalent material with sealed edges and factor painted surfaces.
8. Brackets and Fittings: Corrosion resistant concealed adjustable leveling brackets provided as integral component of framework to allow vertical adjustment of 4 inches.
9. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates, concealed mounting, sequentially numbered with black numbers and letters of at least 3/8 inch high, sequentially numbered starting with number 101.
10. Finish: Bicycle locker manufacturer's factory applied oven baked on, semi-gloss stipple texture finish. Color as selected by Architect from manufacturer's full range.
11. Fastening: Units shall have no exposed fasteners.
12. Door Hardware:

    a. Hinges: Continuous stainless steel piano hinge concealed when door is in the closed position.
    b. Latching: Manufacturer's standard multi-point latching mechanism.
    c. Lock Handle: T-Handle (NAMA Vending Standard) Locks with high security removable plug type cylinder lock for T-handle, UL 437 listed to exceed one million cycles operational testing. Key each locker door cylinder separately.

13. Lock Cylinders and keying: Pick-resistant, high security type with angled key cuts and rotating disc tumblers as manufactured by Abloy Security Locks, Inc. or approved equal.

    a. All cylinders: Underwriter Laboratories Listed (UL 437) standard for key locks.
    b. All lock cylinders are to incorporate a dual-locking principle consisting of a side-bar mechanism and disc tumbler rotation and elevation.
    c. Critical parts of the locking mechanism, pins, shear line, and side bar shall be afforded extra protection from drilling and other forceful attacks by the strategic placement of hardened steel inserts.

d. Furnish locking system in a factory restricted key selection for which uncut keys are not made available from the manufacturer's factory or any other source by normal distribution methods. All key duplication must be done at the factory or authorized service center upon properly authorized signature.
e. Factory shall make available the capability of a minimum of three possible angles of cut on the key blade. All cylinders shall be completely re-keyable to new combinations. The product shall be immediately serviceable on location.
f. Locking mechanism established for this project shall be proprietary and the Owner will furnish to the manufacturer, a list of those persons and their signatures, who will be authorized to order additional materials or duplicate keys. Orders not bearing authorized signatures will be returned.
g. Key each locker door cylinder separately and supply three (3) keys with each.
h. Label Keys with corresponding locker number (by Contractor).
i. Master keys (if master keyed) for this project will be sent by registered mail or UPS AOD (acknowledgement of delivery) from factory directly to the Owner.

2.2 ACCESSORIES

A. Expansion Anchors: Stainless steel anchor bolt and sleeve assembly with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2, with capability to sustain, without failure, a load equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install lockers in compliance with locker manufacturer's written installation instructions.

B. Set bicycle storage lockers plumb and aligned. Level lockers true to plane with adjustments to leveling plates.

C. Anchor base plates of units to concrete slabs with fasteners of sizes recommended by locker manufacturer.

3.2 ADJUSTING, REPAIR, AND CLEANING

A. Adjust doors, latching bar fastening screws, and hardware to operate smoothly, easily, properly, and without binding.

B. Confirm that locks engage accurately and securely without forcing or binding.

C. Touchup Painting: After completing installation, inspect exposed finishes and repair damaged finishes.

D. Clean lockers in accordance with locker manufacturer's written recommendations.

END OF SECTION

SECTION 32 84 00
IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 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 01 90 Existing Landscape Protection
5. Section 32 90 00 Landscape Planting
6. Division 26 00 00 General Electrical

1.2 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. 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.

1.3 DEFINITIONS

A. Piping: All pipe fittings, valves, and accessories as required for a complete piping 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. NEC - National 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.

1.4 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.

1.5 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, F.

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.

1.6 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.

1.7 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.

1.8 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.

1.9 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: Maintain 125 psi water or air pressure in new main line piping for a duration of twenty-four (24) hours. There shall be no drop in pressure during test except that due to ambient temperature changes (+/- 5psi).

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 of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner’s Representative, the Contractor shall notify the Owner’s Representative at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to have the required inspection, 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’s Representative, Owner or Landscape Architect 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. Sprinkler/emitter coverage prior to the start of planting operations.

11. 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.
   3. Submit a Pump Start-up and Training Report after start-up. Include a copy in the O&M manual.

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 construction and as a prerequisite to the start 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.

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.

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.

D. The Booster Pump Assembly shall have a minimum 2 year warranty with no-cost annual service checks over the Warranty Period. See the Booster Pump Assembly and Controls execution section for additional requirements.

PART 2 - PRODUCTS

2.1 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 shown on the Drawings.
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.

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. White rigid polyvinyl chloride (PVC) Fittings:

1. Schedule 40 type I and II grade 1, solvent weld socket fittings ASTM D-2466 for all lateral lines.
2. Schedule 80 type I and II grade 1 solvent weld socket fittings ASTM D-2464 for all main line 2.5 inches and less diameter.
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 to 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. 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 mechanical fittings meeting ANSI/AWWA C110 or C153/A21.10 shall be used for:

1. Main line connections for pipe 3 inches and greater in diameter.
2. New main line service tee at valve connections.
3. Self-restrainted fittings shall be used for bell x flange or bell x threaded fittings.

K. Coated ductile iron service saddles with stainless steel double straps, Romac Industries 202S or equal, shall be used for electric control/quick coupler valve service connections on existing main lines 3 inch or greater.

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.

2.2 BACKFLOW PREVENTION ASSEMBLY

A. Backflow prevention assembly is existing and shall remain in place.

2.3 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. Control Valve Marking: Christy's valve identification tag (or equal), yellow color with text designating controller and valve station number, e.g. "A12", or equivalent.

C. 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. Match size of mainline.

D. Quick Coupling Valve: Two piece quick coupling valve as shown on the Drawings.

2.4 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 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.

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 a branded markings, and concrete lids shall have black paint markings with minimum 1" high letters showing controller letter and station number.

2.5 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 stainless steel 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.

2.6 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.

2.7 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 numbered wire markers at both sides of all splices and at the controller terminal board corresponding to the controller and station number. If multiple valves

are connected to one station, add a two digit indentifier to the station number (X), e.g. X01, X02, etc. Use HellermannTyton Clip-tags nylon numbered wire markers or approved equal.

2.8 IRRIGATION HEADS

A. Spray/Bubbler Pop-up Head: Molded plastic body with pop-up plastic riser and nozzle. Refer to schedule on drawings. Manufacturer's model numbers are listed with description.

B. Rotor Pop-up Head: Molded plastic body with plastic riser and nozzle, stainless steel clad riser if specifically noted or standard. Gear driven rotation with memory arc, balanced nozzle sets. Manufacturer's model numbers are listed with description.

2.9 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 as noted on drawings.

G. Operation indicator shall be a 6 inch pop-up sprinkler body with a no-flow riser, Hunter ECO-INDICATOR, or equal.

2.11 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.

2.12 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

PART 3 - EXECUTION

3.1 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.

3.2 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 are to be placed in the same trench, it is required to maintain a minimum four inch (4") horizontal separation between pipes.
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.
   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 over any lines located out in road surface area of paved streets.
   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 lines.
   g. 4-inch minimum cover over in-line emitter or main distribution tubing.

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 elbows.
   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 two 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 throughout.

3.3 PIPE DEPTH AND 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.

1. 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.

2. 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.

3.4 BACKFLOW PREVENTION ASSEMBLY

A. Check the existing backflow assembly for leaks or any improper condition. Notify the Owner as such if found.

3.5 CONTROL AND TRACER WIRE

A. Protect wire by running alongside of mainline piping. Do not tape wire together when encased in sleeve. 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. Install tracer wire along the top of pipe at the following locations:

1. All pipe sleeves.
2. Main line pipe without adjacent control wire.

3.6 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. 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.

E. 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.

F. 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.

G. Permanently secure the control valve identification label to the top of the valve box lid with non-corrosive connectors.

3.7 AUTOMATIC CONTROLS

A. Install the controller and/or associated equipment, enclosure, sensors, and accessories per the manufacturer’s details and installation requirements, and the construction documents.

B. Connect operational control wires or accessory components to the controller, and program valve schedules appropriately for the new planting.

C. 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.

D. 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.

E. Provide the Owner with fully charged handheld remote controller unit(s) in the quantity indicated on the drawings.

3.8 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 per code requirements.

B. Install grounding rods, plates, etc. per manufacturer's and CEC code requirements.

3.9 SPRINKLER HEAD INSTALLATION

A. 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. Flush all lines prior to installation of heads.

B. Overhead distribution sprinkler heads shall be installed as detailed, set adjacent to the edge of hardscape elements (6 inches for spray heads, 12 inches for rotary heads) and perpendicular to the finish grade. Sprinkler heads shall be a minimum 2 feet, and preferably 3 feet (if planting layout permits) from building walls.

C. Where individual shrub bubblers are installed, each plant shall have a bubbler within 12 inches or less of the shrub rootball.

D. Upon completion of the installation, the Contractor shall adjust or change sprinkler head nozzles to uniformly distribute water without overspray and shall place entire irrigation system in first-class operating condition without any additional cost to the Owner.

E. Sprinkler heads shall be adjusted in order by fully opening the sprinkler furthest from the control valve and working back toward the control valve. Adjust sprinkler heads which spray toward buildings or adjacent hardscape so that water spray does not contact the side of buildings or significantly over-spray onto hardscape .

3.10 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 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..

3.12 CONCRETE

A. Concrete shall be installed in accordance with the relevant portions of the Site Concrete specification section.

3.13 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. If site central control system equipment is installed, the authorized central control distributor/installer shall program the central base station to communicate with the site control system, and shall verify that proper communication protocols are operational.

B. 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.

C. The maintenance period shall not terminate until the close-out documents and as-builts record drawings have been submitted and accepted.

3.14 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 newly planted turfgrass or planting, the Contractor shall reinstall the existing sod if viable, or install a full width of new turfgrass sod or 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

1.1 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. Installation of turfgrass sod
6. Planting new trees, plants and ground covers.
7. Tree drainage sump boring and testing.
8. Root Barriers.
9. Installation of mulch.
10. 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 01 90 Existing Landscape Protection
5. Section 32 84 00 Irrigation System

1.2 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.

1.3 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).

1.4 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 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 adding 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 start of the maintenance period, 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, mowing, aeration and top dressing.

4. Soil Amendment and Seed/Stolon Confirmation Form noting the installed quantities of materials 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.

1.5 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.

1.6 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.

1.7 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.

1.8 OBSERVATIONS

A. The Owner's Representative, Project Inspector or Landscape Architect shall perform periodic observations and shall record the observation on the Landscape Planting Observation Log form on the As Built Record Drawings. 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.

B. Any corrective action called for shall be immediately performed by the Contractor.

C. 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.

1.9 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.

1.11 REPAIR OF DAMAGED EXISTING PLANTING AREAS

A. The Contractor shall be responsible to repair all damage and/or distress to existing planting areas including turfgrass, shrubs, ground covers, perennials, etc., whether specifically shown on the Contract Documents or not, as a result of construction operations, material and/or equipment storage, site access, site offices, utility and/or irrigation line installations or other actions.

B. Replacement shrubs shall be 15 gallon size, replacement ground cover and perennial plants shall be 5 gallon size, and turfgrass shall be full width sod. Damaged areas shall be amended and finish graded per the Contract Documents prior to planting. Non-turfgrass planting areas shall also receive wood mulch as specified herein. The limits of repair shall be determined by the Owner.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil used in planting areas shall be a clean, friable soil with no noxious weeds, clods or stones larger than 0.5 inch in diameter, subsoil, hardpan, wood, debris, fine organic material greater than 5%, undesirable insects, plant disease or any other natural or extraneous objects detrimental to normal plant growth to a minimum depth of 18 inches from finish grade.

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.

2.2 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, and conforming to the following minimums:

1. Certified as “Mature” or better per the California Compost Quality Council Maturity Index.
2. Pass EPA Class A standards for pathogens and heavy metals.
3. Particle size: 1/8" maximum.
4. pH: 6.0-8.0.
5. Macro-nutrients: Minimum of 1.0% Nitrogen, 0.5% Phosphorus, 0.5% Potassium.
6. AgIndex ratio greater than 2.
7. Organic matter content greater than 25% dry weight.
8. Carbon/Nitrogen ratio: less than or equal to 25.
9. Salinity (ECe): less than 5.0 dS/m.
10. Odor shall be soil-like (musty or moldy) without any sour, ammonia-like or putrid smell.

B. Gypsum shall be mined agricultural grade gypsum composed of no less than 100% $CaS0_4$-$2H_20$ 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 40% humic acid from Leonardite.

D. Tri-C Endo 120 Mycorrhizae, MycoApply Ultrafine Endo/Ecto, or equal 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.

2.3 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 turfgrass shall be one or more of the following:

a. Urea 46-0-0
b. BEST Ammonia Sulfate 21-0-0-24S, standard grade, or equal
c. BEST Nitra King 21-2-4-14S-2Fe, or equal.
d. BEST Nitex 20-2-3-12S-5Fe, or equal.
b. Best Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.

2. 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.

2.4 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.

2.5 STAKING & GUYING MATERIALS

A. Stakes: 2" Diameter lodgepole pine, 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.

2.6 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.

2.7 TURFGRASS SOD

A. Sod shall be produced from certified or approved seed/stolons, fresh and labeled in accordance with U. S. Department of Agriculture Rules and Regulations. Sod quality shall be Premium or Standard Grade per TPI specifications.

B. Sod shall be neatly mowed and be mature enough that when grasped at one end it can be picked up and handled without damage, delivered to the project site, adequately protected and installation commenced within 24 hours of harvesting.

C. Turfgrass shall be a species and variety as specified in the Contract Drawings. If a warm-season grass is specified and the installation is to be performed between the months of October and April, a species with an established perennial ryegrass overseeding shall be installed. Submit the overseeded product information for approval prior to the installation.

2.10 ROOT BARRIER

A. A ribbed polyethylene panel of minimum 0.080” thickness equal to Deep Root Partners #UB 24-2 PANEL, (800) 458-7668..

2.11 TREE TRUNK PROTECTOR

A. ArborGard+ polyethylene tree guard by Dimex (800) 334-3776, or equal.

2.12 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.

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 for use on existing established weeds.

2.13 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

3.1 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.

3.2 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 four passes total in different directions (perpendicular and diagonal). 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-traffic turfgrass areas, remove stones and clods greater than three-quarter (0.75) inch in diameter from the top 3 inches of finish grade.

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.

3.3 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 post-emergent contact weed killer at manufacturer's approved rates 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. Perform pre-plant clearing and weed control for native open ground areas planned to receive turfgrass 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, followed by a light roller.
   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.

F. 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.

3.4 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 thirty (30) 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 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 four-fifths native soil and one-fifth Compost by volume. Add Humate and Endo 120 Mycorrhizae at 5 pounds each 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.

3.5 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 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 a mixed planting area shall be 20 percent, and 8.33 percent in turfgrass areas. 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 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 Landscape Architect prior to proceeding with soil conditioning and planting operations.

D. 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.

E. Remove all rocks produced as a result of the soil conditioning and finish grading operations per the requirements of Subsection 3.02.

F. 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 grade modification in existing planted areas at a maximum 12h:1v slope to existing grade, unless shown otherwise on the grading plan.

3.6 MYCORRHIZAE 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 three (3.0) pounds per 1,000 square feet (130 lbs. per acre) per Subsection 3.04, Soil Conditioning. Innocculant shall also be incorporated into the planting backfill per Subsection 3.04, E.

3.7 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).

3.8 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.

3.9 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, if required, per 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 TURFGRASS SOD

A. The area to be planted shall be finish graded to present a smooth and even surface free of humps and hollows and conforming to the finish grading plans. Where new sod is abutting existing turfgrass, fine grade to allow for the thickness of the new sod soil so that the new and existing sod grades are flush. Immediately prior to planting, the surface of the area to be planted shall be sufficiently loose and friable, with adequate moisture to receive the sod. Avoid laying sod on hot or dry soil.

B. Lay first strip of sod slabs along a straight line (use a string in irregular areas). Butt joints tightly. Do not overlap edges. On second strip, stagger head joints (similar to a running bond brick pattern). Use a sharp knife to cut sod in order to fit curves, edges, and sprinkler heads.

C. Install with turf-tired machinery full width sections big roll sod as delivered and flush to adjacent surfaces. Terminating sod edges shall be straight and at right angles to hardscape elements whenever possible.

D. As the sod is being installed, water the sod lightly to prevent drying out. Continue to lay sod and lightly water until installation is complete.

E. After laying sod, roll to eliminate irregularities and to form good contact between sod and soil. Avoid a too heavy roller or excessive initial watering which may cause roller marks.

F. Water the completed lawn surface thoroughly. Topsoil should be constantly moist for a minimum two inches deep. Repeat irrigating at regular intervals to keep sod moist until rooted. The areas shall not be watered to the extent of saturating the soil and causing "flotation" or "flowing" of the top surface of the soil. After water has once been applied, no portion of the planted areas shall be allowed to dry out during the entire maintenance period. After sod roots are established, decrease frequency and increase amount of water per application as necessary to maintain good soil moisture to a minimum 6” depth without standing water or excess runoff. The Contractor shall be responsible to monitor the site and alter the watering times and frequencies to meet site and climatic conditions.

G. Prior to the start of the maintenance period, fill all seam joint gaps greater than 1/8 inch and less than 0.5 inch with washed concrete sand. Fill any joint gaps of 0.5 inch or greater width with a minimum two foot long replacement sod section in order to achieve a tight joint.

H. Replace dead or distressed sod with equivalent material as directed by the Landscape Architect.

I. Do not install turfgrass inside the watering basin of new trees planted in turf areas, or within a 3' radius of existing tree trunks located in turf areas.

3.15 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.

3.16 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 turfgrass areas shall be fully established and have a healthy, uniform and dense stand of grass without weeds, distressed, discolored or bare spots.

C. 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.

D. 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.

3.17 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. 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. The establishment of turfgrass sod is herein defined as being all work necessary to develop sod without weeds or distressed areas with a minimum rooting depth of 2 inches into site soil.

F. 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).

G. 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.

3.18 MAINTENANCE – MOWING AND DRESSING

A. For new sod, mow when 1.4 inch tall and cut down to 1.0 inch.

B. Turfgrass areas shall be mowed during the growing season a minimum of twice a week for warm-season varieties and a minimum of once a week for cool-season

varieties, or at any time the grass reaches 1.4 times its mowing height. Turfgrass shall be edged weekly. The Contractor shall coordinate his watering and weed control schedules to accommodate his mowing schedule. If the Contractor is unable to mow the turf areas on the required day, he has until 5:00 pm of the next day to do the work. After that time, the Owner reserves the right to secure the services of an alternate mowing entity to perform the work. The cost for the alternate mowing will be deducted from monies owed to the Contractor. The Contractor will remain responsible to perform all scheduled mowings and maintenance of the site. The turfgrass shall be mowed and edged, and all trash and debris removed prior to Final Acceptance.

C. At the start of the maintenance period, roll all turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface. Additional topdressing may be required later in the maintenance period if the finish grade planarity is not acceptable.

3.19 MAINTENANCE - FERTILIZATION

A. The Contractor shall fertilize the warm-season turfgrass (Bermudagrass) at the start of the maintenance period and every twenty-eight (28) days with the turfgrass maintenance fertilizer at a rate of 0.75 lb. of actual N /1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall continue the fertilizer applications until the established turf is accepted.

B. 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.

3.20 MAINTENANCE – REPAIR AND WEEDING

A. Between the twenty-first (21) day and the twenty-eigth (28) day after turfgrass planting, the Contractor shall perform the following: replant all spots or areas where normal germination or growth is not evident; remove all rocks or other debris that would constitute a hindrance to mowing or cultivating; repair all damage done by his operations. Where poorly compacted trench backfill shows settlement, remove turfgrass or plants, fill all depressions and eroded channels with sufficient conditioned topsoil to raise to proper grade, compact lightly and replant the filled areas. Roll all replanted turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface.

B. 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).

3.21 FINAL REVIEW

A. A Final Review will be made 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 these 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.

B. 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.

3.22 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 1 Specifications.
B. Section 31 11 00 - Site Clearing.
C. Section 31 22 22 - Soil Materials.
D. Section 31 23 33 - Trench Excavation and Backfill.
E. 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 1 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

1.1 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. 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.

C. 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.

D. 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 Reinforced Concrete. 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.

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 over-excavated, 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 sowing 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 1 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

FOR BID ONLY

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-1 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. Certificates of compliance for material

B. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.

C. 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 cleanouts to be furnished and installed per plans and Plumbing Codes.

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

1. 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 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

FOR BID ONLY

GEOTECHNICAL ENGINEERING INVESTIGATION
COLLEGE OF THE SEQUOIAS, TULARE
PROPOSED CLASSROOM BUILDINGS
4999 E BARDSLEY AVENUE
TULARE, CALIFORNIA 93274

BSK PROJECT G21-396-11F

PREPARED FOR:

COLLEGE OF THE SEQUOIAS
915 SOUTH MOONEY BLVD.
VISALIA, CALIFORNIA 93277

JANUARY 31, 2022

FOR BID ONLY

GEOTECHNICAL ENGINEERING INVESTIGATION
COLLEGE OF THE SEQUOIAS, TULARE
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BSK Project: G21-396-11F

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Appendix B: Laboratory/Field Testing
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DISTRIBUTION LIST: Client (pdf) (Email: byronw@cos.edu)

1 INTRODUCTION

1.1 General

This report presents the results of our Geotechnical Engineering Investigation for the proposed new classroom buildings to be located at 4999 E. Bardsley Avenue in Tulare, California, as shown on the Site Vicinity Map, Figure 1. The geotechnical engineering investigation was conducted in general accordance with the scope of services outlined in BSK Proposal GF21-23087, dated December 9, 2021. The proposed improvements and exploratory borings are shown on Figure 2, Site Plan.

In the event that significant changes occur in the design or location of the proposed structure, the conclusions and recommendations presented in the report will not be considered valid unless the changes are reviewed by BSK and the conclusions and recommendations are modified or verified in writing, as necessary.

1.2 Project Description

We understand that this project consists of the design and construction of a new one-story CTE classroom building approximately 40,000 square-foot with concrete slab-on-grade floor and a steel frame. Structural load is anticipated to be 1,500 pounds per linear foot on continuous footings and to be 60 kips on isolated spread footings. We understand that the project also includes CMU site walls, covered outdoor work/storage areas, covered trash enclosures, solar panel shade canopies, tube steel fencing, AC paving, concrete paving and related site work.

If the actual project description differs significantly from that anticipated above, we should be notified so that we can review our scope of work for applicability.

1.3 Purpose and Scope of Services

The purpose of the geotechnical investigation is to assess soil conditions at the project site and provide geotechnical engineering recommendations for use by the project designers during preparation of the project plans and specifications for the proposed improvements. The scope of the investigation included a field exploration, laboratory testing, engineering analysis, and report preparation.

2 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 Field Exploration

The field exploration, conducted on January 7th, 2022, consisted of a site reconnaissance, and drilling ten (10) exploratory test borings and conducting four (4) CPT tests. The borings were drilled within or adjacent to the proposed improvement areas using a truck-mounted drill rig equipped with hollow stem augers. The borings were advanced to a maximum depth of 51.5 feet below ground surface (bgs). The

CPT tests were conducted to a depth of 50 feet bgs, except for one which met refusal at 27 feet. The approximate boring locations are presented on Figure 2. Details of the field exploration and the boring logs are provided in Appendix A.

2.2 Laboratory Testing

Laboratory testing of selected soil samples were performed to evaluate certain physical, chemical, and engineering characteristics and properties. The testing program included: in-situ moisture and density, shear strength, expansion potential, collapse potential, and corrosion potential. The in-situ moisture and dry density test results are presented on the boring logs in Appendix A. Descriptions of the laboratory test methods and test results are provided in Appendix B.

3 SITE CONDITIONS

3.1 Site Description and Surface Conditions

The project site is situated at an open lot on the southern side of the COS Tulare campus at 4999 E. Bardsley Avenue in Tulare, California. At the time of the field investigation the project site was relatively flat with a dirt surface. There was no significant foliage at the site with the exception of some grass. To the north of the site was a fenced in parking area, and school buildings beyond. To the west was a parking lot, and there were agricultural fields to the east and south. Beyond the campus to the north was Bardsley Avenue.

3.2 Subsurface Conditions

The subsurface soil consisted mostly of sandy silt underlain by silty sand to a maximum depth of exploration (51.5 bgs). Based on experience in the area and based on the boring logs completed at the site, the site soils are relatively consistent, and additional borings are not anticipated to be required. The boring logs in Appendix A provide a more detailed description of the soils encountered in each boring, including the applicable Unified Soil Classification System symbols. The approximate locations of the soil borings are shown on the Site Plan (Figure 2).

3.3 Groundwater

Groundwater was not encountered within the borings to the maximum depth explored, 51.5 feet bgs. The California Department of Water Resources indicates the depth to groundwater at the project site is greater than 20 feet bgs. However, fluctuations in the groundwater level or the presence of perched groundwater may occur due to variations in rainfall, irrigation, seasonal factors, pumping from wells and other factors that were not evident at the time of our investigation.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

Based upon the data collected during this investigation and from a geotechnical engineering standpoint, it is our opinion that there are no soil conditions that would preclude the construction of the proposed improvements provided that the recommendations presented in this report are incorporated into the project design and construction. The planned improvements may be supported on shallow reinforced isolated or continuous concrete spread footings.

4.2 Soil Corrosivity

A surface soil sample obtained from the Site was tested to provide a preliminary screening of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts. The test results are presented in Appendix B.

Based on test results, on-site near-surface soils have low soluble sulfates, low chloride contents, a low minimum resistivity, and are alkaline. Thus, the on-site soils are considered to have mild corrosion potential with respect to buried concrete and a severe corrosive potential for unprotected metal in contact with the soil.

BSK recommends that a Type II cement be used in the formulation of concrete and that buried reinforcing steel protection be provided with a minimum concrete cover required by the American Concrete Institute (ACI) Building Code for Structural Concrete, ACI 318, Chapter 20. Buried metal conduits must have protective coatings in accordance with the manufacturer's specifications. If detailed recommendations for corrosion protection are desired, a corrosion specialist should be consulted.

4.3 Seismic Design Criteria

There are no known active fault zones within the vicinity of the project site. In accordance with Section 1613.2.2 of the 2019 California Building Code (CBC) and Table 20.3-1 of ASCE 7-16, the site can be classified as Site Class D (stiff soil profile).

Use of the 2019 California Building Code (CBC) seismic design criteria is considered appropriate and the following parameters are considered applicable for the structural design of foundations.

Table 1: Seismic Design Parameters			
Seismic Design Parameter	**2019 CBC Value**		**Reference**
MCE Mapped Spectral Acceleration (g)	$S_S = 0.582$	$S_1 = 0.227$	USGS Mapped Value
Amplification Factors (Site Class D)	$F_a = 1.335$	F_v = null[1](2.146)[2]	ASCE Table 11.4
Site Adjusted MCE Spectral Acceleration (g)	$S_{MS} = 0.776$	S_{M1} = null[1](0.487)[2]	ASCE Equations 11.4.1-2
Design Spectral Acceleration (g)	$S_{DS} = 0.518$	S_{D1} = null[1] (0.325)[2]	ASCE Equations 11.4.1-4
Geometric Mean PGA (g)	$PGA_M = 0.341$		Section 11.8.3, ASCE 7-16
Site Short Period – T_s (seconds)	$T_s = 0.627$		$T_s = S_{D1}/ S_{DS}$
Site Long Period – T_L (seconds)	$T_L = 12$		USGS Mapped Value

Notes: [1] Requires site-specific ground motion procedure or exception as per ASCE 7-16 Section 11.4.8.

[2] Values from ASCE 7-16 supplement shall only be used to calculate T_s. Values provided based on use of exception, as provided in Section 11.4.8.2 to Site-Specific Ground Motion Procedures and assumes the value of the seismic response coefficient C_s is determined by Eq. 12.8-2 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_s$ or Eq. 12.8-4 for $T > T_L$.

As shown above, the short period design spectral response acceleration coefficient, S_{DS}, is greater than 0.5, therefore the Site lies in Seismic Design Category D as specified in Section 1613.2.5 of the 2019 CBC. The long period design spectral response acceleration coefficient, S_{D1}, is greater than 0.2, therefore the Site lies in Seismic Design Category D as specified in Section 1613.2.5 of the 2019 CBC. In accordance with the 2019 CBC, each structure shall be assigned to the more severe seismic design category in accordance with Table 1613.2.5(1) or 1613.2.5(2), irrespective of the fundamental period of vibration of the structure.

The site does not lie within a Fault Rupture Hazard Zone as identified by the Alquist-Priolo Fault Zoning Act. The site is not in a Seismic Hazard Zone as specified by the State of California. Based on site topography, our subsurface exploration and our knowledge of the geologic setting, there is no significant risk of ground rupture.

4.4 Site Preparation and Earthwork Construction

The following procedures must be implemented during site preparation for the proposed improvements. It should be noted that references to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D1557 (latest test revision) laboratory test procedures.

1. Prior to any site grading, all miscellaneous surface obstructions must be removed from the improvement area. Near surface soils containing vegetation, roots, organics, or other objectionable material must be stripped to a depth of at least 3-inches to expose a clean soil

surface. Where trees are to be removed, the associated roots may extend 2 to 3 feet below ground surface. As such, deeper excavation may be necessary for root removal. Roots larger than ½-inch in diameter must be removed. Surface strippings must not be incorporated into engineered fill unless the organic content is less than 3 percent by weight (ASTM D2974).

2. Within the area of the planned improvements, remove existing underground utilities and debris to expose a clean soil surface free of deleterious material.

   Existing utilities or irrigation pipes must be removed to a point at least 5-feet horizontally outside the proposed building area. Resultant cavities must be backfilled with engineered fill. Abandoned pipelines to remain that are less than 2 inches in diameter must be capped at the cutoff point, while pipelines greater than 2 inches in diameter must be filled with a 1-sack sand-cement slurry.

3. Soil disturbed as a result of demolition, undocumented fill deemed to possess inadequate compaction or uniformity, debris, and abandoned underground structures must be excavated to expose undisturbed native soil or suitable fill.

4. Following the required demolition, stripping, and/or removal of underground structures, the exposed soil surface in areas to support fill or proposed improvements must be over-excavated a minimum of two feet below existing site grade or one foot below the proposed foundations, which ever depth is greater. The exposed subgrade must be proof-rolled under the observation of a BSK field representative to detect soft or pliant areas. Soft or pliant areas must be over-excavated to firm native soil. Earthwork must extend at least 5-feet laterally beyond the outside edge of proposed improvements and areas to receive fill. Exterior concrete flatwork must have one foot of non-expansive engineered fill soil.

5. Non-expansive excavated soils, free of deleterious substances (organic matter, demolition debris, tree roots, etc.) and with less than 3 percent organic content by weight, may be returned to the excavations as engineered fill. Engineered fill must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture-conditioned to at or above optimum moisture content and compacted to at least 90 percent of the maximum dry density. The upper 12 inches of engineered fill placed as backfill under pavement sections must be compacted to at least 95 percent of the maximum dry density. Acceptance of engineered fill placement must be based on both moisture content at time of compaction and relative compaction.

6. Imported fill materials must be free of deleterious substances and have less than 3 percent organic content by weight. The project specifications must require the contractor to contact BSK for review of the proposed import fill materials for conformance with these recommendations at least two weeks prior to importing to the site, whether from on-site or off-site borrow areas. Imported fill soils must be non-hazardous and be derived from a single, consistent soil type source conforming to the following criteria:

Maximum Particle Size:	3-inches
Percent Passing #4 Sieve:	65 – 100
Percent Passing #200 Sieve:	20 – 45

Plasticity Index:	less than 12
Expansion Index:	< 20
Low Corrosion Potential:	
Soluble Sulfates:	< 1,500 mg/kg
Soluble Chlorides:	< 300 mg/kg
Soil Resistivity:	> 2,000 ohm-cm

Grading operations must be scheduled as to avoid working during periods of inclement weather. Should these operations be performed during or shortly following periods of inclement weather, unstable soil conditions may result in the soils exhibiting a "pumping" condition. This condition is caused by excess moisture, in combination with compaction, resulting in saturation and near zero air voids in the soils. If this condition occurs, the affected soils must be over-excavated to the depth at which stable soils are encountered and replaced with suitable soils compacted as engineered fill. Alternatively, the Contractor may proceed with grading operations after utilizing a method to stabilize the soil subgrade, which must be subject to review by BSK prior to implementation.

4.5 Shallow, and Pole-Type Foundations

Provided the recommendations contained in this report are implemented during design and construction, it is our opinion that the proposed structures can be supported on shallow, mat, or pole-type foundations. A structural engineer must evaluate reinforcement and embedment depth based on the requirements for the structural loadings.

4.5.1 Shallow Foundations

The proposed building may be supported on reinforced concrete spread footings bearing on subgrade soil and engineered fill. The allowable bearing pressure applies to the dead load plus live load (DL + LL), and is presented for lighter and maximum loading, and may be increased by 1/3 for short duration wind or seismic loads. The foundation must be designed with reinforcing steel as recommended by the project Structural Engineer. The allowable bearing capacity presented below considers a safety factor of 3. Footing design must follow the criteria listed below. The estimated total and differential settlement for the recommended spread footings shown below assumes maximum wall and column loads of 1.5 kip/ft and 60 kips, respectively.

TABLE 2 SHALLOW SQUARE FOOTING BEARING CAPACITY AND ESTIMATED SETTLEMENT			
Square Footings			
Minumum Footing Width (in)	Embedment Depth (in)	Bearing Capacity (psf)	Estimated Settlement (in)
24	12	2,700	0.2
36	12	3,200	0.4
48	12	3,800	0.6
60	12	4,300	0.9
24	24	4,000	0.3
36	24	4,500	0.5
48	24	5,000	0.8
60	24	5,200	1.0

Note (1) – Measure with respect to the lowest adjacent subgrade surface

TABLE 3 SHALLOW STRIP FOOTING BEARING CAPACITY AND ESTIMATED SETTLEMENT			
Strip Footings			
Minumum Footing Width (in)	Embedment Depth (in)	Bearing Capacity (psf)	Estimated Settlement (in)
12	12	2,200	0.20
24	12	2,900	0.40
12	24	3,500	0.30
24	24	4,200	0.50

Note (1) – Measure with respect to the lowest adjacent subgrade surface

Isolated footing differential settlement is based on adjacent similarly loaded footings spaced at 30-feet. The settlement values given above are applicable to the maximum loading conditions. For loads other than the design maximum loads, the settlements can be adjusted proportionally. Due to the nature of the foundation soils, a significant fraction of the settlement is expected to occur following the end of construction as the design building loads area applied.

4.5.2 Pole Type Foundations

Structures such as pole barns, signs, etc. may be supported on pole type foundations. This type of foundation must be designed in accordance with Section 1807A.3 of the 2019 CBC. However, it is recommended that an allowable lateral soil bearing pressure of 200 psf per foot of embedment be used to develop parameters S_1 and S_3 rather than one of the values given in Table 1806A.2. This value includes a factor of safety of 2 and may be increased as indicated by 1806A.3 and the footnotes to Table 1806A.2. Unless the area surrounding the pole foundation is paved or covered with concrete flatwork, the upper 24 inches of soil should be ignored when calculating the minimum depth of embedment.

The following table provides expressions for the allowable and ultimate axial capacity using friction to resist axial loads. The skin friction within the upper two feet of embedded length must be ignored in unpaved areas. The total settlement of pier foundations designed in accordance with these recommendations should not exceed one-half inch.

Table 4: Friction Resistance for Vertical Loads	
Allowable (lbs)	**Ultimate (lbs)**
$51\ DL^2$	$127.5\ DL^2$

Note (1) – D is pile diameter (feet), and L is the total embedment length (feet).

Prior to placing concrete, loose or disturbed soils must be removed from the bottom of the drilled pier excavations using a flat bottom clean-out bucket or other pre-approved method. A representative of BSK must observe the drilling and clean-out associated with the construction of pier foundations in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

Pier deflection may govern the design lateral resistance. If provided with pier geometry, lateral load, and loading eccentricity, the estimated pier head deflection can be provided.

4.6 Lateral Earth Pressures and Frictional Resistance

Lateral loads applied against foundations may be resisted by a combination of passive resistance against the vertical faces of the foundations and friction between the foundation bottom and the supporting subgrade. The parameters shown in the table below are for drained conditions of select engineered fill or undisturbed native soil.

TABLE 5 Recommended Lateral Earth Pressures	
Lateral Pressure Condition	Equivalent Fluid Density (pcf)
Active Pressure	37
At-Rest Pressure	57
Passive Pressure	424

An unfactored coefficient of friction of 0.47 may be used between soil subgrade and the foundation bottom. The coefficient of friction and passive earth pressure values given above represent ultimate soil strength values. BSK recommends that a safety factor consistent with the design conditions be included in their usage. For resistance against lateral sliding that is countered solely by the passive earth pressure against footings or friction along the bottom of footings, a minimum safety factor of 1.5 is recommended. For stability against lateral sliding that is resisted by combined passive pressure and frictional resistance, a minimum safety factor of 2.0 is recommended. For lateral resistance against seismic loading conditions, a minimum safety factor of 1.2 is recommended. We based these lateral resistance values on the assumption that the concrete for the foundations is either placed directly against undisturbed soils or that the voids created from the use of forms are backfilled with engineered fill or other approved materials, such as lean concrete. Passive resistance in the upper foot of soil cover below finished grades should be neglected unless the ground surface is confined by concrete slabs, pavements, or other such positive protection.

4.7 Concrete Slabs-on-Grade

Non-structural concrete slab-on-grade must be a minimum of 4-inches thick and must be supported on a compacted subgrade prepared in accordance with the "Site Preparation and Earthwork Construction" section of this report. Existing onsite surface soils are considered to have a low expansion potential for design purposes. In order to regulate cracking of the slabs, construction joints and/or saw-cut control joints must be provided in each direction at a maximum spacing of 10 feet on centers along with steel reinforcement as recommended by the project's Structural Engineer. Control joints must have a minimum depth of one-quarter of the slab thickness. It is recommended that steel reinforcement used in concrete slabs-on-grade consist of steel rebar. Structural concrete slabs-on-grade may be designed using an unadjusted long-term Modulus of Subgrade Reaction (Ks) of 150 pounds per cubic inch (pci) constructed on a properly compacted subgrade or engineered fill. This value is based on the correlations to soil strength using one foot by one foot plate-load tests and should therefore be scaled (adjusted) to the actual slab width. For sandy soils, the adjusted Ks value can be obtained by multiplying the value provided above by $[(B+B_1)/(2B)]^2$, where B is the slab width in feet and B_1 is 1 foot (width of a one foot by one foot plate-load test apparatus).

Interior concrete slabs must be successively underlain by: A durable vapor retarder; 4 inches of gravel aggregate base; and a smooth, compacted subgrade surface. The vapor retarder must meet the requirements of ASTM E1745 Class A and have a water vapor transmission rate (WVTR) of less than or

equal to 0.012 Perms as tested by ASTM E96. Examples of acceptable vapor retarder products include: Stego Wrap (15-mil) Vapor Barrier by STEGO INDUSTRIES LLC; W.R. Meadows Premoulded Membrane with Plasmatic Core; and Zero-Perm by Alumiseal. Because of the importance of the vapor retarder, joints must be carefully spliced and taped.

As indicated in the PCA Engineering Bulletin 119, Concrete Floors and Moisture, and applicable ACI Committee reports (see ACI 360R-06, Design of Slabs-on-Ground, dated October 2006 and ACI 302.1R-04, Guide for Concrete Floor and Slab Construction, dated June 2004), the concrete slab can be placed on top of the vapor retarder. The advantage of this option is that it can reduce the amount of moisture that can be transmitted through the slab (especially if the sand layer becomes moist or wet prior to placing the concrete); however, the risk of slab "curling" is much greater. The "curling" may result from a sharp contrast in moisture-drying conditions between the exposed slab surface and the surface in contact with the membrane. As recommended in the referenced ACI Committee reports, measures must be taken to reduce the risk of "curling" such as reducing the joint spacing, using a low shrinkage mix design, and reinforcing the concrete slab. In order to regulate cracking of the slab, we recommend that full depth construction joints and control joints be provided in each direction with slab thickness and steel reinforcing recommended by the structural engineer.

Excessive landscape water or leaking utility lines could create elevated moisture conditions under concrete slabs, which could result in adverse moisture or mildew conditions in floor slabs or walls. Accordingly, care must be taken to avoid excess irrigation around the structures, as well as to periodically monitor for leaking utility lines. Likewise, positive surface drainage must be provided around the perimeter of the structures as discussed in the "Surface Drainage Control" Section 4.10.

The adverse effects of moisture vapor transmission on flooring materials can be substantially reduced by the use of a low porosity concrete. This can be achieved by specifying a low water-cement ratio (0.45 or less by weight) a minimum compressive strength of 4,000 psi at 28 days, and a minimum of 7 days wet-curing.

4.8 Excavation Stability

Soils encountered within the upper 5-feet are generally Type C soil in accordance with OSHA (Occupational Safety and Health Administration). Temporary excavations for the project construction must be left open for as short a time as possible and must be protected from water runoff. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations 29 CFR Part 1926, or successor regulations). These excavation recommendations are based on soil characteristics derived from the borings. Variations in soil conditions will likely be encountered during excavation. At the time of construction, BSK must be afforded the opportunity to observe and document sloping and shoring conditions, and the opportunity

to provide review of actual field conditions to account for condition variations not otherwise anticipated in the preparation of these recommendations.

4.9 Utility Trench Excavation and Backfill

Pipes and conduits must be bedded and shaded in accordance with the requirements of the pipe manufacturer. Where no specific requirements exist, we recommend a minimum of 6-inches of sand bedding material for pipe installations 12 to 24-inches in diameter. For pipe diameters smaller than 12-inches, the bedding thickness may be reduced to 4-inches. The bedding material and envelope (up to 6-inches above the pipe) must consist of sand (Sand Equivalent greater than 30), be placed in loose lifts not exceeding 8-inches in thickness, compacted to at least 90 percent of the maximum dry density, and moisture conditioned to within 2 percent of optimum moisture content. Water jetting to attain compaction must not be allowed.

Adequate excavation width must be provided to permit uniform compaction on both sides of utility lines installed within the trench. The trench backfill material may consist of engineered fill. Trench backfill outside the building footprint must be placed in loose lifts not to exceed 8-inches in loose thickness, compacted to at least 90 percent of the maximum dry density, and moisture conditioned to within 2 percent of optimum moisture content. The upper 12-inches of trench backfill below pavement sections must be compacted to at least 95 percent of the maximum dry density. Conduits extending through or below footings must be “sleeved” as determined by the Project Structural Engineer. Utility trench backfill beneath the building areas must be backfilled in accordance with Section 4.3 (Site Preparation and Earthwork Construction).

4.10 Surface Drainage Control

Final grading around site improvements must provide for positive and enduring drainage. Ponding of water must not be allowed on or near the building or paved surfaces. Saturation of the soils immediately adjacent to or below the building area must not be allowed. Irrigation water must be applied in amounts not exceeding those required to offset evaporation, sustain plant life, and maintain a relatively uniform moisture profile around and below, site improvements.

5 PLANS AND SPECIFICATIONS REVIEW

BSK recommends that it be retained to review the draft plans and specifications for the project, with regard to foundations, and earthwork, prior to their being finalized and issued for construction bidding.

6 CONSTRUCTION TESTING AND OBSERVATIONS

Geotechnical testing and observation during construction is a vital extension of this geotechnical investigation. BSK recommends that it be retained for those services. Field review during site

preparation and grading allows for evaluation of the exposed soil conditions and confirmation or revision of the assumptions and extrapolations made in formulating the design parameters and recommendations. BSK's observations must be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. BSK must also be called to the site to observe foundation excavations, prior to placement of reinforcing steel or concrete, in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. BSK must also be called to the site to observe placement of foundation and slab concrete.

If a firm other than BSK is retained for these services during construction, that firm must notify the owner, project designers, governmental building officials, and BSK that the firm has assumed the responsibility for all phases (i.e., both design and construction) of the project within the purview of the geotechnical engineer. Notification must indicate that the firm has reviewed this report and any subsequent addenda, and that it either agrees with BSK's conclusions and recommendations, or that it will provide independent recommendations.

7 LIMITATIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings performed at the locations shown on Figure 2. The report does not reflect variations which may occur between or beyond the borings. The nature and extent of such variations may not become evident until additional exploration and testing is performed or construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of the variations.

The validity of the recommendations contained in this report is also dependent upon an adequate testing and observation program during the construction phase. BSK assumes no responsibility for construction compliance with the design concepts or recommendations unless it has been retained to perform the testing and observation services during construction as described above.

The findings of this report are valid as of the present. However, changes in the conditions of the site can occur with the passage of time, whether caused by natural processes or the work of man, on this property or adjacent property. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, governmental policy or the broadening of knowledge.

BSK has prepared this report for the exclusive use of the Client and members of the project design team. The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Tulare County at the time the report was written. No other warranties either express or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.

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FIGURES

REFERENCE IMAGE: Google Earth

BSK ASSOCIATES
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Tel. (559) 497-2880

SITE VICINITY MAP

COS Campus Tulare Ph II
4999 E Bardsley Avenue
Tulare, California

FIGURE 1

JOB NO.	G21-396-11F
DATE	January 12, 2022
DR. BY	TG
CH. BY	OML
SCALE AS SHOWN	
SHEET NO.	1
OF	1 SHEETS

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LEGEND:

B-10 APPROXIMATE BORING LOCATIONS

CPT-4 APPROXIMATE CPT TESTING LOCATIONS

REFERENCE IMAGE: Google Earth

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BORING LOCATION MAP

COS Campus Tulare Ph II
4999 E Bardsley Avenue
Tulare, California

FIGURE 2

JOB NO. G21-396-11F
DATE January 12, 2022
DR. BY TG
CH. BY OML
SCALE AS SHOWN
SHEET NO. 1
OF 1 SHEETS

C:\Users\tgonzalez\BSK Associates\BSK Documents - FRS Projects Active\GEO\G21396-11F - COS Campus Tulare Ph II\Graphics\G21-396-11F.dwg User:tgonzalez Plotted:Jan 12, 2022 - 10:47am Last Save:Jan 11, 202

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APPENDIX A

FIELD EXPLORATION

APPENDIX A
Field Exploration

The field exploration, conducted on January 7th, 2022, consisted of a site reconnaissance, and drilling ten (10) exploratory test borings and conducting four (4) CPT tests. The borings were drilled within or adjacent to the proposed improvement areas using a truck-mounted drill rig equipped with hollow stem augers. The borings were advanced to a maximum depth of 51.5 feet below ground surface (bgs). The CPT tests were conducted to a depth of 50 feet bgs, except for one which met refusal at 27 feet. The approximate boring locations are presented on Figure 2. Details of the field exploration and the boring logs and CPT logs are provided below.

The soil materials encountered in the test borings were visually classified in the field and logs were recorded during the drilling and sampling operations. Visual classification of the materials encountered in the test borings were made in general accordance with the Unified Soil Classification System (ASTM D2487). A soil classification chart is presented herein. Boring logs are presented herein and should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff on the basis of observations made at the time of drilling while the actual boundaries between different soil types may be gradual and soil conditions may vary at other locations.

Subsurface samples were obtained at the successive depths shown on the boring logs by driving samplers which consisted of a 2.5-inch inside diameter (I.D.) California Sampler or a 1.4-inch I.D. Standard Penetration Test (SPT) Sampler. The samplers were driven 18 inches using a 140-pound, automatic hammer dropping 30 inches. The number of blows required to drive the last 12 inches was recorded as the blow count (blows/foot) on the log of borings. The relatively undisturbed soil core samples were capped at both ends to preserve the samples at their natural moisture content. Disturbed soil samples were obtained using the Split-Spoon Sampler (marked X in logs) and were placed and sealed in polyethylene bags. At the completion of the field exploration, the test borings were backfilled with the soil cuttings, as set forth in BSK's proposal.

It should be noted that the use of terms such as "loose", "medium dense", "dense" or "very dense" to describe the consistency of a soil is based on sampler blow count and is not necessarily reflective of the in-place density or unit weight of the soils being sampled. The relationship between sampler blow count and consistency is provided in the following Tables A-1 and A-2 for coarse grained (sandy and gravelly) soils and fine grained (silty and clayey) soils, respectively.

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Table A-1: Density of Coarse-Grained Soil versus Sampler Blow Count		
Consistency	SPT Blow Count Blows / Foot)	2.5" I.D. Cal. Sampler (Blows / Foot)
Very Loose	<4	<6
Loose	4 – 10	6 – 15
Medium Dense	10 – 30	15 – 45
Dense	30 – 50	45 – 80
Very Dense	>50	>80

Table A-2: Consistency of Fine-Grained Soil versus Sampler Blow Count		
Consistency	SPT Blow Count (Blows / Foot)	2.5" I.D. Cal. Sampler (Blows / Foot)
Very Soft	<2	<3
Soft	2 – 4	3 – 6
Medium Stiff	4 – 8	6 – 12
Stiff	8 – 15	12 – 24
Very Stiff	15 – 30	24 – 45
Hard	>30	>45

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MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than Half > #200 sieve	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 15% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 15% FINES	SM	SILTY SANDS, POOORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than Half < #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR 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 CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS 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

■	Modified California	RV	R-Value
☒	Standard Penetration Test (SPT)	SA	Sieve Analysis
⊠	Split Spoon	SW	Swell Test
◪	Pushed Shelby Tube	TC	Cyclic Triaxial
	Auger Cuttings	TX	Unconsolidated Undrained Triaxial
	Grab Sample	TV	Torvane Shear
⊘	Sample Attempt with No Recovery	UC	Unconfined Compression
CA	Chemical Analysis	(1.2)	(Shear Strength, ksf)
CN	Consolidation	WA	Wash Analysis
CP	Compaction	(20)	(with % Passing No. 200 Sieve)
DS	Direct Shear	▽	Water Level at Time of Drilling
PM	Permeability	▼	Water Level after Drilling(with date measured)
PP	Pocket Penetrometer		

SOIL CLASSIFICATION CHART AND LOG KEY

Figure A-1

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Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-01**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2	■									
3	■		37	100	19.3					
4										
5	■							SM	**Silty SAND** - olive brown, moist, fine to medium grained sand	
6	■		26	110.8	8.4					
7										
8										
9										
10	■							SP-SM	**Poorly Graded SAND with SILT** - yellowish olive, moist, fine to coarse grained sand	
11	■		12							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-02**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2										
3			46	100.7	18.3					
4										
5										
6			40	115.4	7.8					Direct Shear: Phi = 33 degrees, C = 20 psf
7										
8										
9										
10								SM	**Silty SAND** - olive brown, moist, fine grained sand	
11			20	103.9	20					
12										
13										
14										
15									... yellowish brown, fine to coarse grained sand	
16			14							
17										
18										
19										
20									... olive brown, fine grained sand	
21			23	115.1	15.4					#200 Sieve: 56% Passing @ 21'
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 51.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-02**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
									Silty SAND - olive brown, moist, fine grained sand *(continued)*	
26	X		33						... olive, fine to medium grained sand	
27										
28										
29										
30	■									
31	■		53	109.4	19.1					#200 Sieve: 44% Passing @ 31'
32										
33										
34										
35	X								... olive yellow, fine grained sand	
36	X		18							
37										
38										
39										
40	■									
41	■		34	98.8	23.5					#200 Sieve: 50% Passing @ 41'
42										
43										
44										
45	X								... fine to medium grained sand	
46	X		18							
47										
48										
49										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 51.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-02**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
51	■		41	107.9	12.6				**Silty SAND** - olive brown, moist, fine grained sand *(continued)*	#200 Sieve: 41% Passing @ 51'
52									Boring terminated at approximately 51.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
53										
54										
55										
56										
57										
58										
59										
60										
61										
62										
63										
64										
65										
66										
67										
68										
69										
70										
71										
72										
73										
74										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 51.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-03**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2	■									
3	■		30	90.8	15.0					
4										
5	■							SM	**Silty SAND** - olive brown, moist, fine grained sand	
6	■		34	102.7	8.8					
7										
8										
9										
10	■									
11	■		100							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Telephone: (559) 497-2880

Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-04**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2	■									
3	■		24	83.4	19.1					
4										
5	■							SM	**Silty SAND** - yellowish brown, moist, fine to medium grained sand	
6	■		47	110.7	6.9					
7										
8										
9										
10	■									
11	■		11							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-05**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - very pale brown, moist, fine grained sand	
2	■									
3	■		57	88.8	10.9					
4										
5	■							SM	**Silty SAND** - olive brown, moist, fine to medium grained sand	
6	■		23	108.5	3.3					
7										
8										
9										
10	■								... fine grained sand	
11	■		43							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Telephone: (559) 497-2880

Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-06**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2	■									
3	■		34	93.1	15.5					
4										
5	■							SM	**Silty SAND** - olive yellow, moist, fine grained sand	
6	■		16	99.1	5.9					
7										
8										
9										
10	■									
11	■		9							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Fresno, CA 93650
Telephone: (559) 497-2880

Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-07**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								SM	**Silty SAND** - olive brown, moist, fine to medium grained sand	
2	■									
3	■		9	93.6	19.8					
4										
5	■									
6	■		22	98.5	20.3					
7										
8										
9										
10	■									
11	■		36							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Fresno, CA 93650
Telephone: (559) 497-2880

Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-08**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2	■									
3	■		52	100.8	14.1					
4										
5	■							SM	**Silty SAND** - yellowish brown, moist, fine grained sand	
6	■		51	101.7	9.5					
7										
8										
9										
10	■								... white striations	
11	■		49	103.2	13.1					
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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Fresno, CA 93650
Telephone: (559) 497-2880

Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-09**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2	■									
3	■		30	82.5	20.6					
4										
5	■							SM	**Silty SAND** - olive brown, moist, fine grained sand	
6	■		16							
7										
8										
9										
10	■							SP-SM	**Poorly Graded SAND with SILT** - yellowish olive, moist, fine to coarse grained sand	
11	■		11							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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550 W. Locust Ave.
Fresno, CA 93650
Telephone: (559) 497-2880

Project: COS Tulare
Location: 4999 E Bardsley Avenue
Project No.: G21-396-11F
Logged By: T. Gorham
Checked By: O. M. Lau

Boring: **B-10**

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								ML	**Sandy SILT** - yellowish brown, moist, fine grained sand	
2	■									
3			25	85.1	20.8					
4										
5	■							SM	**Silty SAND** - dark yellowish brown, moist, fine to medium grained sand	
6			18	92.0	12.3					
7										
8										
9										
10	■							SP-SM	**Poorly Graded SAND with SILT** - yellowish olive, moist, fine to coarse grained sand	
11			14							
12									Boring terminated at approximately 11.5 feet bgs. No Groundwater encountered Boring backfilled with soil cuttings.	
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Drilling Contractor: Baja Exploration
Drilling Method: Mobile B-61
Drilling Equipment: Hollow Stem Auger
Date Started: 1/7/22
Date Completed: 1/7/22

Surface Elevation:
Sample Method: 2.5" I.D. Cal Mod & 1.5" I.D. SPT Split Spoon
Groundwater Depth: Not Encountered
Completion Depth: 11.5 Feet
Borehole Diameter: 8"

* See key sheet for symbols and abbreviations used above.

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APPENDIX B

LABORATORY TESTING

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APPENDIX B
Laboratory Testing

The results of laboratory testing performed in conjunction with this project are contained in this Appendix. The following laboratory tests were performed on soil samples in general conformance with applicable standards.

In-Situ Moisture and Density

The field moisture content and in-place dry density determinations were performed on relatively undisturbed samples obtained from the test borings. The field moisture content, as a percentage of dry weight of the soils, was determined by weighing the samples before and after oven drying in accordance with ASTM D2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in accordance with ASTM D2937 test procedures. Test results are presented on the boring logs in Appendix A.

Direct Shear Test

One (1) direct shear test was performed on test specimens trimmed from a selected soil samples. The three-point shear tests were performed in general accordance with ASTM D3080, Direct Shear Test for Soil under Consolidated Drained Conditions. The test specimens, each 2.42 inches in diameter and 1 inch in height, were subjected to shear along a plane at mid-height after allowing for pore pressure dissipation. The test results are presented on Figure B-1.

Expansion Index Test

One (1) Expansion Index Test was performed on a bulk soil sample obtained at the time of drilling in the area of planned construction to determine the expansion characteristics of the sample. The test was performed in general accordance with UBC Standard 18-2/ ASTM Test Method D4829. The test results are presented in Figure B-2.

Collapse Potential Test

Two (2) Collapse Potential Tests were performed on relatively undisturbed soil samples to evaluate collapse potential characteristics. The tests were performed in general accordance with ASTM D5333. The sample was initially loaded under as-received moisture content to a selected stress level, loaded to a maximum load of 2000 psf and then saturated. The test results are presented on Figures B-3 and B-4.

Soil Corrosivity

The results of chemical analyses performed on a bulk soil sample using California Test Method (CT) 643 (for minimum resistivity and pH) and CT 417 and 422 (for soluble sulfate and chlorides, respectively) are presented in Table B-1.

TABLE B-1
SUMMARY OF CHEMICAL TEST RESULTS

Test Boring	Sample Depth	pH	Sulfate (mg/kg)	Chloride (mg/kg)	Minimum Resistivity (ohms-cm)
B-5	0 - 5'	7.3	25	Not Detected	890

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Fax: (559) 497-2886

FIGURE B-1

Direct Shear Test

ASTM D-3080

Project Name:	COS Tulare	**Sampled By:**	T. Gorham	**Sample Date:**	1/7/2022
		Tested By:	D. Messfin	**Test Date:**	1/11/2022
Project Number:	G21-396-11F	**Lab Tracking ID:**	N/A	**Report Date:**	1/13/2022
Sample Location:	B-2 @ 6'	**Sample Description:**	Sandy SILT (ML) - yellowish brown, moist, fine grained sand		

SHEAR STRENGTH DIAGRAM

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Expansion Index of Soils

ASTM D 4829 / UBC Standard 18-2

FIGURE B-2

550 W. Locust Avenue
Fresno, CA 93650
Ph: (559) 497-2868
Fax: (559) 485-6140

Project Name: COS Tulare
Report Date: 1/20/2021
Project Number: G21-396-11F
Sample Date: 1/7/2022
Lab Tracking ID:
Test Date: 1/18/2022
Sample Location: B-5 @ 0-5'
Sample Source
Sampled By: T. Gorham **Tested By:** D. Messfin **Reviewed By:** O.M. Lau

TEST DATA

INITIAL SET-UP DATA			
Sample + Tare Weight (g)	712.5		
Tare Weight (g)	368.6	**FINAL TAKE-DOWN DATA**	
		Moisture Content Data	
Wet Weight + Tare	120.6	Wet Weight + Tare	755.6
Dry Weight + Tare	105.3	Dry Weight + Tare	665.4
Tare Weight (g)	12.5	Tare Weight (g)	373.7
Moisture Content (%)	16.5%	Moisture Content (%)	30.9%
Initial Volume (ft^3)	0.007272	Final Volume (ft^3)	0.007349
Remolded Wet Density (pcf)	104.3	Final Wet Density (pcf)	116.0
Remolded Dry Density (pcf)	89.5	Final Dry Density (pcf)	88.6
Degree of Saturation	**50**	**Degree of Saturation**	**93**

EXPANSION READINGS

Initial Gauge Reading (in)	0.252
Final Gauge Reading (in)	0.2625
Expansion (in)	0.0105

Uncorrected Expansion Index	**11**
Corrected Expansion Index, EI	**11**

Classification of Expansive Soil

EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

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COLLAPSE POTENTIAL
ASTM D-5333

FIGURE B-3

550 W. Locust Ave.
Fresno, CA 93650
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Fax: (559) 497-2886

Project Name:	COS Tulare	**Sampled By:**	T. Gorham	**Sample Date:**	1/11/22
		Tested By:	D.Messfin	**Test Date:**	1/25/22
Project Number:	G21-396-11F	**Lab Tracking ID:**	N/A	**Report Date:**	1/13/21
Sample Location:	B-5 @ 6'	**Sample Description:**	Silty SAND (SM) - olive brown, moist, fine to medium grained sand		

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FIGURE B-4

550 W. Locust Ave.
Fresno, CA 93650
Ph: (559) 497-2880
Fax: (559) 497-2886

COLLAPSE POTENTIAL
ASTM D-5333

Project Name:	COS Tulare	**Sampled By:**	T. Gorham	**Sample Date:**	1/11/22
		Tested By:	D.Messfin	**Test Date:**	1/25/22
Project Number:	G21-396-11F	**Lab Tracking ID:**	N/A	**Report Date:**	1/13/21
Sample Location:	B-10 @ 6'	**Sample Description:**	Silty SAND (SM) - dark yellowish brown, moist, fine to medium grained sand		

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APPENDIX C

SEISMIC ANALYSIS

GEOLOGIC/SEISMIC HAZARD EVALUATION
COLLEGE OF SEQUOIAS
COS CAMPUS TULARE PH II
4999 EAST BARDSLEY AVENUE
TULARE, CALIFORNIA

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C1. INTRODUCTION

This report presents the geologic and seismic hazards assessment prepared in accordance with Section 1803A.6 of the 2019 California Building Code (CBC), CCR Title 24, Chapters 16A and 18A requirements for a Geotechnical/Engineering Geologic Report. The assessment was performed in conformance with California Geological Survey (CGS) Note 48 (2019

C1.1 Purpose and Scope of Services

The purpose of the geologic and seismic hazards assessment is to provide the Client with an evaluation of potential geologic or seismic hazards which may be present at the site or due to regional influences. BSK's scope of services for this of the proposed building 19 remodel assessment included the following:

1. Review of published geologic literature, and current and past investigations at the site;
2. Evaluation of the data collected and preparation of a geologic cross section;
3. Evaluation of potential geologic hazards affecting the site;
4. Determination of Site Class and seismic design parameters.

The observations and conclusions presented in this report specifically exclude the assessment of environmental characteristics, particularly those involving hazardous substances, and a high-pressure pipeline risk evaluation.

C1.2 Site Location

The College of the Sequoias, Tulare Campus is located at 4999 East Bardsley, Tulare County, California (Site). Figure C-1 presents a topographic map showing the Site location and surrounding area.

The coordinates of the proposed new development are:

Latitude 36.19389°N
Longitude 119.28231°W

The surrounding area mostly consists of agricultural properties. The adjacent properties are currently vacant or used for agriculture or rural residences.

C1.3 Site Topography

As shown on Figure C-1, the site and surrounding area topography is relatively flat with a ground surface elevation of approximately 195 feet, USGS datum.

C1.4 Groundwater Conditions

The Site is located within the Kaweah sub-basin of the San Joaquin Basin Hydrologic Study Area. This includes approximately the southern two-thirds of the Great Valley. Within the San Joaquin Basin Hydrologic Study Area, 39 groundwater basins and areas of potential storage have been identified. The boundaries of these areas are based largely on hydrologic as well as political considerations.

Groundwater was not observed in our January 2022 soil borings completed to a depth of 51.5 feet below the ground surface (bgs). Please note that the groundwater level may fluctuate both seasonal and from year to year due to variations in rainfall, temperature, pumping from wells and possibly as the result of other factors that were not evident at the time of our investigation.

To ascertain groundwater levels for the area during other time periods, groundwater elevation data from the California Department of Water Resources (DWR) were obtained for the period 1926 to 1958. Groundwater elevation hydrograph from one well within close proximity to the Site is presented on Figure C-2. The hydrograph indicates that the highest historic groundwater elevation in the general area of the site was approximately 283.8 feet in 1943. Using a Site elevation of 295 feet, the shallowest historic depth to groundwater was approximately 11 feet bgs.

C2.0 GEOLOGIC SETTING

The Site is located within the Great Valley geomorphic province which lies within the structural region identified by Bartow, 1991, as the San Joaquin Valley portion of the southern Sierran block. This area forms a broad syncline with deposits of marine and overlying continental sediments, Jurassic to Holocene in age. The thickness of the sediments increases to the west and reach a thickness of as much as 20,000 feet on the west side of the San Joaquin Valley syncline. East of the site, the relatively flat geomorphology transitions into the foothills of Sierra Nevada, which generally consist of pre-Cretaceous metamorphic rocks and Mesozoic granitic rocks.

As shown on Figure C-3, the Site is situated near the contact of recent basin deposits and recent alluvial fan deposits derived from the Sierra Nevada Mountain Range to the east.

Nearby active faults include the Great Valley thrust fault system located approximately 38 miles southwest of the Site, the Lost Hills fault located 45 miles southwest of the site, the San Andreas Fault located approximately 64 miles southwest of the Site and the Kern Canyon fault located 48 miles east of the Site.

C2.1 Subsurface Conditions

The Site was the subject of a field investigation consisting of ten soil borings and four CPT test holes completed to a maximum depth of approximately 51.5 feet bgs. The soil units present beneath the site

were observed to be mostly of silty sand, sandy silt and clayey silt to depths of approximately 15 feet bgs. Beneath this, layers of alternating layers of silty sand, sandy silt, clay and silty clay were encountered.

C3.0 GEOLOGIC/SEISMIC HAZARDS

The types of geologic and seismic hazards assessed include surface ground fault rupture, liquefaction, seismically induced settlement, slope failure, flood hazards and inundation hazards.

C3.1 Fault Rupture Hazard Zones in California

The purpose of the Alquist-Priolo Geologic Hazards Zones Act, as summarized in CDMG Special Publication 42 (SP 42), is to "prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." As indicated by SP 42, "the State Geologist is required to delineate "earthquake fault zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting.

The Site is not located in a Fault-Rupture Hazard Zone. The closest Fault-Rupture Hazard Zone is associated with the Pond fault located approximately 33 miles south of the Site. There are no mapped active faults crossing the Site or projecting toward the Site, therefore the potential for fault surface rupture is low.

C3.2 State of California Seismic Hazard Zones (Liquefaction and Landslides)

Zones of Required Investigation referred to as "Seismic Hazard Zones" (SHZ) in CCR Article 10, Section 3722, are areas shown on Seismic Hazard Zone Maps where site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements.

The Site is located within the United States Geologic Survey (USGS), Tulare 7.5 Minute Quadrangle and is not currently identified by the State of California as being within a Seismic Hazard Zone.

C3.3 Local General Plans Safety Element

Geologic hazard zones were not identified in 2014 The *City of Tulare General Plan*. The County of Tulare 2030 General Plan Update did not identify geologic hazard zones in the county.

C3.4 Slope Stability and Potential for Slope Failure

The project area is essentially flat and the potential hazard due to landslides from adjacent properties is not applicable.

C3.5 Flood and Inundation Hazards

An evaluation of flooding at the site includes review of potential hazards from flooding during periods of heavy precipitation and flooding due to a catastrophic dam breach from up-gradient surface impoundments.

C3.5.1 Flood Hazards

Federal Emergency Management Agency (FEMA) flood hazard data was obtained to present information regarding the potential for flooding at the Site. As shown on Figure C-6, the Site is in Zone X, inside the 500-year floodplain and outside the 100-year floodplain (FEMA Flood Hazard Layer NFHL_06107C,, dated 12/05/2014).

C3.5.2 Inundation Hazards - Dams

As shown on Figure C-7, the Site is located in the pathway of inundation from a catastrophic breach of Terminus dam.

C3.6 Volcanic Hazards

According to USGS Bulletin 1847, dated 1989, the site is not located in an area which would be subject to hazards from volcanic eruptions (Miller, 1989).

C3.7 Corrosion

Please refer to the section titled “Corrosion Assessment” in the geotechnical report for discussion of the corrosivity of the site soils.

C3.8 Expansive Soils

As discussed in the geotechnical report, the near-surface soils encountered at the Site, exhibit a low expansion potential with an Expansion Index of 11.

C3.9 Land Subsidence

Four types of subsidence are known to occur in the San Joaquin Valley (Galloway, 1999). In order of decreasing magnitude, they are:

(1) Subsidence caused by aquifer system compaction due to the lowering of ground-water levels by sustained ground-water overdraft;
(2) Subsidence caused by the hydrocompaction of moisture-deficient deposits above the water table;
(3) Subsidence related to fluid withdrawal from oil and gas fields; and
(4) Subsidence related to crustal neotectonic movements.

The site is not located in an area known to be susceptible to subsidence due to petroleum withdrawal. As shown on Figure C-8 the Site is located in an area of low to moderate subsidence due to groundwater

withdrawal. Impacts to the Site from regional subsidence are not anticipated. The site is not located in an area in which soils are known to be impacted by hydrocompaction.

C4. SEISMIC HAZARD ASSESSMENT

C4.1 Seismic Source Deaggregation

Figure C-9 presents a regional fault map showing the major faults which may have the potential to impact the Site. Seismically induced ground motion at a site can be caused by earthquakes on any of the sources surrounding the site. Deaggregation of the seismic hazard was performed by using the USGS Interactive Deaggregation website. The deaggregation determination, at the maximum considered earthquake (MCE) hazard level, results in distance, magnitude and epsilon (ground-motion uncertainty) for each source that contributes to the hazard. Each source has a corresponding epsilon, which is the probabilistic value relative to the mean value of ground motion for that source.

Deaggregation based on a probabilistic model developed by the USGS indicates that the extreme seismic source with the highest magnitude that contributes to the peak ground acceleration (PGA) is a magnitude 8.1 earthquake from the San Andreas Fault. For liquefaction and seismic settlement, the modal magnitude (Mw) of 5.5 with a distance of 10.0 km would be appropriate for probabilistic input parameter that is consistent with the design earthquake ground motion.

C4.2 Historical Seismicity

Table C-1 provides the location, earthquake magnitude, Site to earthquake distances, dates and the resulting site peak horizontal acceleration for the period 1800 to 2021. Figure C-10 presents historical earthquake magnitudes and locations relative to the Site.

TABLE C-1 HISTORIC EARTHQUAKES WITHIN 100 MILES OF THE SITE GROUND MOTION GREATER THAN 0.07G							
File Code	Latitude (North)	Longitude (West)	Date	Depth (km)	Earthquake Magnitude	Site Acceleration (g)	Distance mi (km)
T-A	36.170	119.320	07/25/1868	0	5.0	0.29	2.9(4.7)
DMG	35.300	119.800	01/09/1857	0	7.9	0.16	68.4(110.1)
DMG	36.700	118.100	03/26/1872	0	7.8	0.15	74.1(119.3)
DMG	35.000	119.017	7/21/1952	0	7.7	0.13	83.9(135.0)
BRK	36.220	120.290	5/2/1983	0	6.7	0.10	56.3(90.7)
DMG	35.750	120.250	3/10/1922	0	6.5	0.08	62.4(100.4)
GSP	35.770	117.599	7/6/2019	8	7.1	0.08	98.4(158.3)
PAS	36.151	120.049	8/4/1985	6	5.8	0.08	43.0(69.2)
T-A	34.830	118.750	11/27/1852	0	7.0	0.08	98.9(159.1)
T-A	36.170	119.320	07/25/1868	0	5.0	0.29	2.9(4.7)

The Table C-1 shows that the Site has experienced mean plus one sigma peak horizontal acceleration up to 0.29g from a local magnitude 5.0 earthquake. In general, the Site has been subjected to relatively low intensity ground motion, primarily from large earthquakes on distance faults and low magnitude earthquakes closer to the Site.

C4.3 Earthquake Ground Motion, 2019 California Building Code

C4.3.1 Site Class

Based on Section 1613A.3.2 of the 2019 California Building Code (CBC), the Site shall be classified as Site Class A, B, C, D, E or F based on the Site soil properties and in accordance with Chapter 20 of ASCE 7-16. The estimated average shear wave velocity ranged from 250 m/s (819 ft/s) to 266 m/s (873 ft/s), as measured from the three CPTs. Based on this, as per Table 20.3-1 of ASCE 7-16, the Site is Class D (600 ft/s ≤ Vs ≤ 1,200 ft/s).

C4.3.2 Seismic Design Criteria

The 2019 California Building Code (CBC) utilizes ground motion based on the Risk-Targeted Maximum Considered Earthquake (MCE_R) that is defined in the 2019 CBC as the most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk. Ground motion parameters in the 2019 CBC are based on ASCE 7-16, Chapter 11.

The USGS has prepared maps presenting the Risk-Targeted MCE spectral acceleration (5% damping) for periods of 0.2 seconds (SS) and 1.0 seconds (S1). The values of SS and S1 can be obtained from the OSHPD Seismic Design Maps Application available at:
https://seismicmaps.org/

Table C-2 below presents the spectral acceleration parameters produced for Site Class D by the OSHPD Ground Motion Parameter Application and Chapter 16 of the 2019 CBC based on ASCE 7-16.

TABLE C-2 SPECTRAL ACCELERATION PARAMETERS RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE			
Criteria	**Value**		**Reference**
MCE Mapped Spectral Acceleration (g)	S_S = 0.583	S_1 = 0.228	USGS Mapped Value
Site Coefficients (Site Class D)	F_a = 1.334	F_v = Null[1](2.144)[2]	ASCE Table 11.4
Site Adjusted MCE Spectral Acceleration (g)	S_{MS} = 0.777	S_{M1} = Null[1](0.489)[2]	ASCE Equations 11.4.1-2
Design Spectral Acceleration (g)	S_{DS} = 0.518	S_{D1} = Null[1](0.326)[2]	ASCE Equations 11.4.3-4
Site Short Period - T_S (Seconds)	Ts = 0.629		Ts = S_{D1}/ S_{DS}
Site Long-Period - T_L (Seconds)	T_L = 12		USGS Mapped Value

ASCE 7-16 Section 11.4.8 requires a site-specific ground motion analysis with Site Class D and E sites with S1 greater than or equal to 0.2. It is assumed that the ASCE 7-16 Section 11.4.8 exception #2 will be used for this Site.

C4.3.3 Geometric Mean Peak Ground Acceleration

As per Section 1803A.5.12 of the CBC, peak ground acceleration (PGA) utilized for dynamic lateral earth pressures and liquefaction, shall be based on a site specific study (ASCE 7-16, Section 21.5) or ASCE 7-16, Section 11.8.3. The USGS Ground Motion Parameter Application based on ASCE 7-16, Section 11.8.3 produced the values shown in Table C-3 based on Site Class D.

TABLE C-3 GEOMETRIC MEAN PEAK GROUND ACCELERATION MAXIMUM CONSIDERED EARTHQUAKE		
Criteria	**Value**	**Reference**
Mapped Peak Ground Acceleration (g)	PGA = 0.254	USGS Mapped Value
Site Coefficients (Site Class D)	F_{PGA} = 1.346	ASCE Table 11.8-1
Geometric Mean PGA (g)	PGA_M = 0.342	ASCE Equations 11.8-1

[1] Requires site-specific ground motion procedure or exception as per ASCE 7-16 Section 11.4.8
[2] Values from ASCE 7-16 supplement, shall only be used to calculate Ts

C4.4 Seismically Induced Ground Failure

C4.4.1 Liquefaction

Settlement of the ground surface with consequential differential movement of structures is a major cause of seismic damage for buildings founded on alluvial deposits. Vibration settlement of relatively dry and loose granular deposits beneath structures can be readily induced by the horizontal components of ground shaking associated with even moderate intensity earthquakes. Silver and Seed (1971) have demonstrated that settlement of dry sands due to cyclic loading is a function of 1) the relative density of the soil; 2) the magnitude of the cyclic shear stress; and 3) the number of strain cycles. As indicated above, seismically-induced ground settlement can also occur due to the liquefaction of relatively loose, saturated granular deposits.

In order for liquefaction triggering to occur due to ground shaking, it is generally accepted that four conditions will exist:

1. The subsurface soils are in a relatively loose state
2. The soils are saturated
3. The soils have low plasticity
4. Ground shaking is of sufficient intensity to act as a triggering mechanism

We estimate the historical depth to groundwater to be 11 feet bgs. A liquefaction/seismic settlement analysis was performed using the program Liquefy Pro version 5.8k using data from CPT-1, CPT-2, CPT-4 and soil boring B-2.

Input parameters for the liquefaction and settlement analysis were based upon:

- PGA based upon the geometric mean peak ground acceleration or 0.342.
- Magnitude 5.5 of controlling earthquake from Deaggregation of the seismic hazard.
- Assumed depth to groundwater of 11 feet bgs from historical high.
- A Factor-of-Safety of 1.3 was used for analysis.

The results of our liquefaction and seismic settlement analysis based upon the CPT-1, CPT-2, CPT-4 and soil boring B-2 are provided on Figures C-11, C-12, C-13 and C-14, respectively. Based on our liquefaction analysis, the overall liquefaction potential is low. The analysis from CPT-4 data shows liquefaction may occur in some very thin zones at depths of 11.8 feet to 12.8 feet and from 37.6 feet to 38.2 feet, during the design earthquake.

C4.4.2 Lateral Spread

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material. These phenomena typically occur adjacent to free faces such as slopes and creek channels. Sloped ground or

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channel free-faces are not present in the area, therefore the potential for lateral spreading to take place at the site is low.

C4.4.3 Dynamic Compaction/Seismic Settlement

Another type of seismically induced ground failure, which can occur as a result of seismic shaking, is dynamic compaction, or seismic settlement. Such phenomena typically occur in unsaturated, loose granular material or uncompacted fill soils.

A seismic settlement analysis was performed using the program Liquefy Pro version 5.8k using soil boring data from using data from the 2010 soil boring B-10B.

Input parameters for the liquefaction and settlement analysis were based upon:

- PGA based upon the geometric mean peak ground acceleration or 0.342.
- Magnitude 5.5 of controlling earthquake from Deaggregation of the seismic hazard.
- Assumed depth to groundwater of 11 feet bgs from historical high.
- A Factor-of-Safety of 1.3 was used for analysis.

Based on the analysis the estimated total seismic settlement and differential settlement is minimal.

C5. REFERENCES

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0 1,000 2,000 4,000
Feet

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College of the Sequoias
COS Campus Tulare Ph II
4999 East Bardsley Avenue
Tulare, California

Figure C-1
Topographic Map
BSK Project G2139611F

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Groundwater Levels for Well 361961N1192781W001

Download

Measurement Date (PST)	Reference Point Elevation	Ground Surface Elevation	Distance from RP to WS	Groundwater Elevation	Ground Surface to Water Surface	Measurement Issue	Collecting Agency	Water Level Measurement Comments
10/15/1943 00:00:00	298.910	298.710	15.1	283.81	14.9		Department of Water Resou...	
08/16/1927 00:00:00	298.910	298.710	15.2	283.71	15		Department of Water Resou...	
10/23/1941 00:00:00	298.910	298.710	15.6	283.31	15.4		Department of Water Resou...	
10/22/1942 00:00:00	298.910	298.710	16.6	282.31	16.4		Department of Water Resou...	
06/14/1946 00:00:00	298.910	298.710	17.4	281.51	17.2		Department of Water Resou...	
04/20/1927 00:00:00	298.910	298.710	18.1	280.81	17.9		Department of Water Resou...	
10/30/1945 00:00:00	298.910	298.710	18.6	280.31	18.4		Department of Water Resou...	

State Well Number: 20S25E17A001M
Latitude (NAD83): 36.1961
Longitude (NAD83): -119.2781
Basin Subbasin Name (Code): Kaweah (5-022.11)
Reference Point Elevation (NAVD88 ft): 298.910
Ground Surface Elevation (NAVD88 ft): 298.710

Document Path: T:\GIS-Files\Project-Files\Geotech\G2139611F - COS Tulare\Figure C-2 Hydrograph.mxd

Map Date: 1/25/2022

Reference: http://www.water.ca.gov/waterdatalibrary/index.cfm

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Figure C-2
Area Hydrograph
BSK Project G2139611F

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LEGEND

Qf - Recent Fan Deposits
Qb - Recent Basin Deposits
Ql - Quaternary Lake Deposits
Qc - Pleistocene Nonmarine

N
W E
S

0 1 2 4
Miles

Reference: Geologic Map of California, Fresno Sheet, 1965

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Figure C-3
Geologic Map
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N
W E
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0 50 100 200
Feet

Map Date: 1/25/2022

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COS Campus Tulare Ph II
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Tulare, California

Figure C-3
Site Map
BSK Project G2139611F

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LEGEND

Unit Contact

Soil Boring/CPT Location

Groundwater Level (Year)

NOTES:
1) Locations are Approximate.

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0 50 100
Approximate Scale in Feet
Horizontal=Vertical

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Tulare, California

BSK Project G2139611B
Geologic Cross Section
A-A'
Figure C-5

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0 1 2 4 Miles

Reference: Federal Emergency Management Agency (FEMA), Flood Hazard Layer NFHL_06107C, Effect. Date 12/05/2014

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Tulare, California

Figure C-6
Flood Hazard Map
BSK Project G2139611F

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N
W E
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0 4 8 16 Miles

Reference: Department of Water Resources, Dam Breach Inundation Map Web Publisher, July 1, 2020
https://fmds.water.ca.gov/webgis/?appid=dam_prototype_v2
California Emergency Management Agency, Flood Inundation GIS files (Federal Dams)

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4999 East Bardsley Avenue
Tulare, California

Figure C-7
Inundation Map
BSK Project G2139611F

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0 2.5 5 10 Miles

N W E S

Reference: Data based on Interferometric Synthetic Aperture Radar (InSAR) from JPL
https://data.cnra.ca.gov/dataset/nasa-jpl-insar-subsidence

Map Date: 1/26/2022

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Figure C-8
Area Subsidence
BSK Project G2139611F

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N
W E
S

0 7.5 15 30

Scale in Miles

Reference: Quaternary Faults=USGS Quaternary Fault Database
ftp://hazards.cr.usgs.gov/maps/qfault/
Pre-Quarternary Faults= Fault Activity Map of California (2010) California Geological Survey
https://maps.conservation.ca.gov/cgs/fam/app/

Legend

Fault Activity Age

- Historic
- Latest Quaternary
- Late Quaternary
- Middle and Late Quaternary
- Undifferentiated Quaternary
- Pre-Quaternary Faults

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College of the Sequoias
COS Campus Tulare Ph II
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Tulare, California

Figure C-9
Area Fault Map
BSK Project G2139611F

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N
W E
S

0 12.5 25 50
Miles

Source: National Seismic Hazard Model (NSHM) Earthquake Catalogs, 2014 NSHM Catalogs, USGS, https://github.com/usgs/nshmp-haz-catalogs

Map Date: 1/26/2022

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Figure C-10
Earthquake Epicenter Map
BSK Project G2139611F

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=CPT-1 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

LiquefyPro CivilTech Software USA www.civiltech.com

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Figure C-11

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=CPT-1 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

LiquefyPro CivilTech Software USA www.civiltech.com

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Input File Name: T:\Project Docs\G2139611F - COS Campus Tulare Ph II\CPT-1.liq
Title: College of the Sequoias
Subtitle:

Surface Elev.=
Hole No.=CPT-1
Depth of Hole= 50.00 ft
Water Table during Earthquake= 11.00 ft
Water Table during In-Situ Testing= 60.00 ft
Max. Acceleration= 0.34 g
Earthquake Magnitude= 5.50

Input Data:
Surface Elev.=
Hole No.=CPT-1
Depth of Hole=50.00 ft
Water Table during Earthquake= 11.00 ft
Water Table during In-Situ Testing= 60.00 ft
Max. Acceleration=0.34 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.01 in.
Total Settlement of Saturated and Unsaturated Sands=0.01 in.
Differential Settlement=0.003 to 0.004 in.

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=CPT-2 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

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Figure C-12

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=CPT-2 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

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Figure C-12

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    Input File Name: T:\Project Docs\G2139611F - COS Campus Tulare Ph II\CPT-2.liq
    Title:  College of the Sequoias
    Subtitle:

    Surface Elev.=
    Hole No.=CPT-2
    Depth of Hole= 50.00 ft
    Water Table during Earthquake= 11.00 ft
    Water Table during In-Situ Testing= 60.00 ft
    Max. Acceleration= 0.34 g
    Earthquake Magnitude= 5.50

 Input Data:
    Surface Elev.=
    Hole No.=CPT-2
    Depth of Hole=50.00 ft
    Water Table during Earthquake= 11.00 ft
    Water Table during In-Situ Testing= 60.00 ft
    Max. Acceleration=0.34 g
    Earthquake Magnitude=5.50
    No-Liquefiable Soils:   Based on Analysis

    1. CPT Calculation Method: Modify Robertson*
    2. Settlement Analysis Method: Tokimatsu, M-correction
    3. Fines Correction for Liquefaction: Stark/Olson et al.*
    4. Fine Correction for Settlement: During Liquefaction*
    5. Settlement Calculation in: All zones*
    9. User request factor of safety (apply to CSR) ,   User= 1.3
       Plot one CSR curve (fs1=User)
    10. Use Curve Smoothing: No
    * Recommended Options

Output Results:
    Settlement of Saturated Sands=0.00 in.
    Settlement of Unsaturated Sands=0.02 in.
    Total Settlement of Saturated and Unsaturated Sands=0.02 in.
    Differential Settlement=0.010 to 0.013 in.
```

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=CPT-4 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

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Figure C-13

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=CPT-4 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

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Figure C-13

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    Input File Name: T:\Project Docs\G2139611F - COS Campus Tulare Ph II\CPT-4.liq
    Title:  College of the Sequoias
    Subtitle:

    Surface Elev.=
    Hole No.=CPT-4
    Depth of Hole= 50.00 ft
    Water Table during Earthquake= 11.00 ft
    Water Table during In-Situ Testing= 60.00 ft
    Max. Acceleration= 0.34 g
    Earthquake Magnitude= 5.50

 Input Data:
    Surface Elev.=
    Hole No.=CPT-4
    Depth of Hole=50.00 ft
    Water Table during Earthquake= 11.00 ft
    Water Table during In-Situ Testing= 60.00 ft
    Max. Acceleration=0.34 g
    Earthquake Magnitude=5.50
    No-Liquefiable Soils:   Based on Analysis

    1. CPT Calculation Method: Modify Robertson*
    2. Settlement Analysis Method: Tokimatsu, M-correction
    3. Fines Correction for Liquefaction: Stark/Olson et al.*
    4. Fine Correction for Settlement: During Liquefaction*
    5. Settlement Calculation in: All zones*
    9. User request factor of safety (apply to CSR) ,   User= 1.3
       Plot one CSR curve (fs1=User)
    10. Use Curve Smoothing: No
    * Recommended Options

Output Results:
    Settlement of Saturated Sands=0.00 in.
    Settlement of Unsaturated Sands=0.01 in.
    Total Settlement of Saturated and Unsaturated Sands=0.01 in.
    Differential Settlement=0.006 to 0.008 in.
```

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=B-2 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

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Figure C-14

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LIQUEFACTION ANALYSIS

College of the Sequoias

Hole No.=B-2 Water Depth=11 ft

Magnitude=5.5
Acceleration=0.342g

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Figure C-14

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Input File Name: T:\Project Docs\G2139611F - COS Campus Tulare Ph II\B-2.liq
Title: College of the Sequoias
Subtitle:

Surface Elev.=
Hole No.=B-2
Depth of Hole= 51.50 ft
Water Table during Earthquake= 11.00 ft
Water Table during In-Situ Testing= 60.00 ft
Max. Acceleration= 0.34 g
Earthquake Magnitude= 5.50

Input Data:
Surface Elev.=
Hole No.=B-2
Depth of Hole=51.50 ft
Water Table during Earthquake= 11.00 ft
Water Table during In-Situ Testing= 60.00 ft
Max. Acceleration=0.34 g
Earthquake Magnitude=5.50
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.3
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
2.00	30.00	119.00	80.00
5.00	26.00	124.00	80.00
10.00	13.00	125.00	56.00
15.00	14.00	125.00	56.00
20.00	15.00	133.00	56.00
25.00	33.00	133.00	56.00
30.00	35.00	130.00	44.00
35.00	18.00	130.00	44.00
40.00	22.00	123.00	50.00
45.00	18.00	123.00	50.00
50.00	27.00	122.00	41.00

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.01 in.
Total Settlement of Saturated and Unsaturated Sands=0.01 in.
Differential Settlement=0.003 to 0.005 in.

DSA

GL-4

PROJECT SUBMITTAL GUIDELINE: CALGREEN CODE

Division of the State Architect (DSA) documents referenced within this publication are available on the DSA Forms or Publications webpages.

Projects submitted to DSA for review, as a single project or as increments, must comply with the Title 24, Part 11, California Green Building Standards Code (CALGreen).

DSA-SS CALGreen regulatory requirements consists of compliance with the scoping requirements in CALGreen Chapter 3, Section 301.4 and the Nonresidential Mandatory Measures adopted by DSA-SS in Chapter 5. Please refer to the Chapter 5 Matrix Adoption Tables for each Division for the specific Mandatory Measures adopted by DSA-SS.

The measures outlined in CALGreen Chapter 5, Section 5.410.2 for building and site Commissioning and Section 5.410.4 for building and site Testing and Adjusting are *not* mandatory requirements for schools and community colleges; however, portions of these regulations are required by the California Energy Code with which all facilities must comply. For mandatory Commissioning requirements under the California Energy Code, including installation and acceptance testing requirements, refer to Energy Code Section 120.8. Although not adopted by DSA-SS, the additional design measures for Commissioning in CALGreen Section 5.410.2 and the verification measures for Testing and Adjusting under CALGreen Section 5.410.4 are encouraged and recommended.

CALGreen Section 306 Voluntary Measures encourages building practices that improve public health, safety and general welfare by promoting the use of building concepts which minimize the building's impact on the environment, and promote a more sustainable design. Chapter 5 Nonresidential Mandatory Measures that are not adopted as mandatory measures by DSA-SS are voluntary measures recommended and encouraged for the design, construction, verification, and maintenance of non-energy systems. Appendix A5, Divisions A5.1 through A5.5 outline means of achieving enhanced sustainable design and construction by incorporating voluntary measures that exceed the mandatory measures.

Attachment 1 lists the CALGreen Nonresidential Mandatory Measures adopted by DSA-SS. For the complete text, consult the 2019 Title 24, Part 11, California Green Building Standards Code. For Project Submission, check the CALGreen Mandatory Measures that are applicable to and have been incorporated into the Project and submit this Guideline (checklist) with the application.

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Attachment 1

2019 CALIFORNIA GREEN BUILDING STANDARDS CODE

Division of the State Architect – Structural Safety (DSA-SS)
(CCR, Title 24, Part 11)

CHAPTER 3 – GREEN BUILDING

SECTION 301 – GENERAL

301.4 Mandatory measures for public schools and community colleges. [DSA-SS] New building construction and site work on a new or existing site shall comply with Section 301.4.

301.4.1 Building and site construction on a new site shall comply with Chapter 5 as adopted by DSA-SS.

301.4.2 Work on an existing site shall comply with Section 301.4.2.

301.4.2.1 Newly constructed site work shall comply with Chapter 5 as adopted by DSA-SS.

301.4.2.2 Newly constructed buildings shall comply with Chapter 5 as adopted by DSA-SS and Section 301.4.3.

301.4.2.3 Additions to existing buildings shall comply with Section 301.4.3.

301.4.2.4 Rehabilitated landscape areas shall comply with Sections 5.304.6 and 5.106.12.

301.4.3 Minimum rehabilitated landscape area requirement. A minimum rehabilitated landscape area equal to 75 percent of the footprint area of the building shall comply with Section 5.304.6 and Section 106.12. New buildings or additions to existing buildings less than 1,600 square feet shall not be required to comply with Section 301.4.3.

CHAPTER 5 – NONRESIDENTIAL MANDATORY MEASURES

DIVISION 5.1 – PLANNING AND DESIGN

SECTION 5.106 – SITE DEVELOPMENT

5.106.4.2 Bicycle parking. [DSA-SS] For public schools and community colleges, comply with Sections 5.106.4.2.1 and 5.106.4.2.2.

☐ **5.106.4.2.1 Student bicycle parking.** Provide permanently anchored bicycle racks conveniently accessed with a minimum of four two-bike capacity racks per new building.

☐ **5.106.4.2.2 Staff bicycle parking.** Provide permanent secure bicycle parking conveniently accessed with a minimum of two staff bicycle parking spaces per new building. Acceptable parking facilities shall be convenient from the street or staff parking area and shall meet one of the following:

1. Covered, lockable enclosures with permanently anchored racks for bicycles;
2. Lockable bicycle rooms with permanently anchored racks; or
3. Lockable, permanently anchored bicycle lockers.

☐ **5.106.5.3 Electric vehicle (EV) charging. [N]** Construction shall comply with Section 5.106.5.3.1 or Section 5.106.5.3.2 to facilitate future installation of electric vehicle supply equipment (EVSE). When EVSE(s) is/are installed, it shall be in accordance with the

California Building Code, the *California Electrical Code* and as follows:

☐ **5.106.5.3.1 Single charging space requirements. [N]** When only a single charging space is required per Table 5.106.5.3.3, a raceway is required to be installed at the time of construction and shall be installed in accordance with the *California Electrical Code.* Construction plans and specifications shall include, but are not limited to, the following:

1. The type and location of the EVSE.
2. A listed raceway capable of accommodating a 208/240-volt dedicated branch circuit.
3. The raceway shall not be less than trade size 1 inch.
4. The raceway shall originate at a service panel or a subpanel serving the area, and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet, box, enclosure or equivalent.
5. The service panel or subpanel shall have sufficient capacity to accommodate a minimum 40-amprere dedicated branch circuit for the future installation of the EVSE.

☐ **5.106.5.3.2 Multiple charging space requirements. [N]** When multiple charging spaces are required per Table 5.106.5.3.3 raceway(s) is/are required to be installed at the time of construction and shall be installed in accordance with the *California Electrical Code.* Construction plans and specifications shall include, but are not limited to, the following:

1. The type and location of the EVSE.
2. The raceway(s) shall originate at a service panel or a subpanel(s) serving the area, and shall terminate in close proximity to the proposed location of the charging equipment and into listed suitable cabinet(s), box(es), enclosure(s) or equivalent.
3. Plan design shall be based upon 40-amprere minimum branch circuits.
4. Electrical calculations shall substantiate the design of the electrical system, to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to simultaneously charge all required EVs at its full rated amperage.
5. The service panel or subpanel(s) shall have sufficient capacity to accommodate the required number of dedicated branch circuit(s) for the future installation of the EVSE.

EV charging space calculation. [N] Table 5.106.5.3.3 shall be used to determine if single or multiple charging space requirements apply for the future installation of EVSE.

Exceptions: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1. Where there is insufficient electrical supply.
2. Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 5.106.5.3, may adversely impact the construction cost of the project.

TABLE 5.106.5.3.3	
TOTAL NUMBER OF ACTUAL PARKING SPACES	**NUMBER OF REQUIRED EV CHARGING SPACES**
0 – 9	0
10 – 25	1
26 – 50	2
51 – 75	4
76 – 100	5
101 – 150	7
151 – 200	10
201 and over	6 percent of total [1]

1. Calculation for spaces shall be rounded up to the nearest whole number.

☐ **5.106.5.3.4 [N] Identification.** The service panel or subpanel(s) circuit directory shall identify the reserved overcurrent protective device space(s) for future EV charging as "EV CAPABLE". The raceway termination location shall be permanently and visibly marked as "EV CAPABLE."

☐ **5.106.5.3.5 [N] Future charging spaces.** Future charging spaces qualify as designated parking as described in Section 5.106.5.2 Designated parking for clean air vehicles.

☐ **5.106.8 Light pollution reduction. [N]** Outdoor lighting systems shall be designed and installed to comply with the following:

1. The minimum requirements in the *California Energy Code* for Lighting Zones 0 to 4 as defined in Chapter 10, Section 10-114 of the *California Administrative Code,* and
2. Backlight, (B) ratings as defined in Illuminating Engineering Society of North America (IESNA) TM-15-11*(shown in TABLE A-1 in Chapter 8),* and
3. Uplight and Glare ratings as defined in *California Energy Code* (shown in TABLES 130.2-A and 130.2-B in Chapter 8) and
4. Allowable Backlight, Uplight, and Glare (BUG) ratings not exceeding those shown in Table 5.106.8 [N], or Comply with a local ordinance lawfully enacted pursuant to Section 101.7, whichever is more stringent.

Exceptions: [N]

1. Luminaires that qualify as exceptions in Section 140.7 of the *California Energy Code.*
2. Emergency lighting.
3. Building facade meeting the requirements in Table 140.7-B of the *California Energy Code*, Part 6.
4. Custom lighting features as allowed by the local enforcing agency, as permitted by Section 101.8 Alternate materials, designs and methods of construction.

Notes:

1. **[N]** See also *California Building Code,* Chapter 12, Section 1205.7 for college campus lighting requirements for parking facilities and walkways.
2. Refer to Chapter 8 (Compliance Forms, Worksheets and Reference Material) for Illuminating Engineering Society Technical Memorandum TM-15-11 Table A-1, *California Energy Code* Tables 130.2-A and 130.2-B.
3. Refer to the California Energy Code for requirements for additions and alterations.

TABLE 5.106.8 [N]

MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT, AND GLARE (BUG) RATINGS
(See CALGreen for TABLE)

☐ **5.106.10 Grading and paving.** Construction plans shall indicate how site grading or a drainage system will manage all surface water flows to keep water from entering buildings. Examples of methods to manage surface water include, but are not limited to, the following:

1. Swales.
2. Water collection and disposal systems.
3. French drains.
4. Water retention gardens.
5. Other water measures which keep surface water away from buildings and aid in groundwater recharge.

Exception: Additions and alterations not altering the drainage path.

☐ **5.106.12 Shade trees. [DSA-SS]** Shade trees shall be planted to comply with Sections 5.106.12.1, 5.106.12.2, and 5.106.12.3. Percentages shown shall be measured at noon on the summer solstice. Landscape irrigation necessary to establish and maintain tree health shall comply with Section 5.304.6.

☐ **5.106.12.1 Surface parking areas.** Shade tree plantings, minimum #10 container size or equal, shall be installed to provide shade over 50% of the parking area within 15 years.

Exception: The surface parking area covered by solar photovoltaic shade structures, or shade structures with roofing materials that comply with Table A5.106.11.2.2 in Appendix A5, are not included in the total area calculation.

☐ **5.106.12.2 Landscape areas.** Shade trees plantings, minimum #10 container size or equal, shall be installed to provide shade over 20% of the landscape area within 15 years

Exception: Playfields for organized sport activity are not included in the total area calculation.

☐ **5.106.12.3 Hardscape areas.** Shade trees plantings, minimum #10 container size or equal, shall be installed to provide shade over 20% of the hardscape area within 15 years.

Exception: Walks, hardscape areas covered by solar photovoltaic shade structures, and hardscape areas covered by shade structures with roofing materials that comply with Table A5.106.11.2.2 in Appendix A5, are not included in the total area calculation.

DIVISION 5.2 – ENERGY EFFICIENCY

SECTION 5.201 – GENERAL

☐ **5.201.1 California Energy Code.** For the purposes of mandatory energy efficiency standards in this code, the California Energy Commission will continue to adopt mandatory standards.

DIVISION 5.3 – WATER EFFICIENCY AND CONSERVATION

SECTION 5.303 – INDOOR WATER USE

5.303.3 Water conserving plumbing fixtures and fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:

☐ **5.303.3.1 Water closets.** The effective flush volume of all water closets shall not exceed 1.28 gallons per flush. Tank-type water closets shall be certified to the performance criteria of the U.S. EPA WaterSense Specifications for Tank-Type Toilets.

Note: The effective flush volume of dual flush toilets is defined as the composite, average flush volume of two reduced flushes and one full flush.

5.303.3.2 Urinals.

☐ **5.303.3.2.1 Wall mounted urinals**. The effective flush volume of wall mounted urinals shall not exceed 0.125 gallons per flush.

☐ **5.303.3.2.2 Floor mounted urinals**. The effective flush volume of floor mounted or other urinals shall not exceed 0.5 gallons per flush.

5.303.3.3 Showerheads

☐ **5.303.3.3.1 Single showerhead.** Showerheads shall have a maximum flow rate of not more than 1.8 gallons per minute at 80 psi. Showerheads shall be certified to the performance criteria of the U.S. EPA WaterSense Specifications for showerheads.

☐ **5.303.3.3.2 Multiple showerheads serving one shower**. When a shower is served by more than one showerhead, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 gallons per minute at 80 psi, or the showerhead shall be designed to allow only one shower outlet to be in operation at one time.

Note: A hand-held shower shall be considered a showerhead.

5.303.3.4 Faucets and fountains.

☐ **5.303.3.4.1 Non-residential lavatory faucets.** Non-residential lavatory faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi.

☐ **5.303.3.4.2 Kitchen faucets.** Kitchen faucets shall have a maximum flow rate of not more than 1.8 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.8 gallons per minute at 60 psi.

5.303.3.4.3 Wash fountains. Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute/20 [rim space (inches) at 60 psi].

☐ **5.303.3.4.4 Metering faucets.** Metering faucets shall not deliver more than 0.20 gallons per cycle.

☐ **5.303.3.4.5 Metering faucets for wash fountains.** Metering faucets for wash fountains shall have a maximum flow rate of not more than 0.20 gallons per cycle/20 [rim space (inches) at 60 psi].

Note: Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.

☐ **5.303.6 Standards for plumbing fixtures and fittings.** Plumbing fixtures and fittings shall be installed in accordance with the *California Plumbing Code*, and shall meet the applicable standards referenced in Table 1701.1 of the *California Plumbing Code* and in Chapter 6 of this code**.**

SECTION 5.304 – OUTDOOR WATER USE

5.304.6 Outdoor potable water use in landscape areas. For public schools and community colleges, landscape projects as described in Sections 5.304.6.1 and 5.304.6.2 shall comply with the California Department of Water Resources Model Water Efficient Landscape Ordinance (MWELO) commencing with Section 490 of Chapter 2.7, Division 2, Title 23, *California Code of Regulations*, except that the Evapotranspiration Adjustment Factor (ETAF) shall be 0.65 with an additional water allowance for special landscape areas (SLA) of 0.35.

Exception: Any project with an aggregate landscape area of 2,500 square feet or less may comply with the prescriptive measures contained in Appendix D of the MWELO.

☐ **5.304.6.1 Newly constructed landscapes.** New construction projects with an aggregate landscape area equal to or greater than 500 square feet.

☐ **5.304.6.2 Rehabilitated landscapes.** Rehabilitated landscape projects with an aggregate landscape area equal to or greater than 1,200 square feet.

DIVISION 5.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY

SECTION 5.407 – WATER RESISTANCE AND MOISTURE MANAGEMENT

☐ **5.407.1 Weather protection.** Provide a weather-resistant exterior wall and foundation envelope as required by *California Building Code,* Section 1402.2 (Weather Protection), manufacturer's installation instructions, or local ordinance, whichever is more stringent.

5.407.2 Moisture control. Employ moisture control measures by the following methods:

☐ **5.407.2.1 Sprinklers.** Design and maintain landscape irrigation systems to prevent spray on structures.

5.407.2.2 Entries and openings. Design exterior entries and/or openings subject to foot traffic or wind-driven rain to prevent water intrusion into buildings as follows:

☐ **5.407.2.2.1 Exterior door protection.** Primary exterior entries shall be covered to prevent water intrusion by using nonabsorbent floor and wall finishes within at least 2 feet around and perpendicular to such openings plus at least one of the following:

1. An installed awning at least 4 feet in depth.
2. The door is protected by a roof overhang at least 4 feet in depth.
3. The door is recessed at least 4 feet.
4. Other methods which provide equivalent protection.

☐ **5.407.2.2.2 Flashing.** Installed flashings integrated with a drainage plane.

SECTION 5.408 – CONSTRUCTION WASTE REDUCTION, DISPOSAL AND RECYCLING

5.408.1 Construction waste management. Recycle and/or salvage for reuse a minimum of 65 percent of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1, 5.408.1.2 or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent.

☐ **5.408.1.1 Construction waste management plan.** Where a local jurisdiction does not have a construction and demolition waste management ordinance that is more stringent, submit a construction waste management plan that:

1. Identifies the construction and demolition waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.

2. Determines if construction and demolition waste materials will be sorted on-site (source-separated) or bulk mixed (single stream).
3. Identifies diversion facilities where construction and demolition waste material collected will be taken.
4. Specifies that the amount of construction and demolition waste materials diverted shall be calculated by weight or volume, but not by both.

☐ **5.408.1.2 Waste management company.** Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with this section.

Note: The owner or contractor shall make the determination if the construction and demolition waste material will be diverted by a waste management company.

Exceptions to Sections 5.408.1.1 and 5.408.1.2:

1. Excavated soil and land-clearing debris.
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.
3. Demolition waste meeting local ordinance or calculated in consideration of local recycling facilities and markets.

☐ **5.408.1.3 Waste stream reduction alternative.** 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.

☐ **5.408.1.4 Documentation.** Documentation shall be provided to the enforcing agency which demonstrates compliance with Section 5.408.1.1 through 5.408.1.3. The waste management plan shall be updated as necessary and shall be accessible during construction for examination by the enforcing agency.

Notes:

1. Sample forms found in "A Guide to the California Green Building Standards Code (Nonresidential)" located at www.bsc.ca.gov/Home/CALGreen.aspx may be used to assist in documenting compliance with the waste management plan.
2. Mixed construction and demolition debris (C&D) processors can be located at the California Department of Resources Recycling and Recovery (CalRecycle).

SECTION 5.410 – BUILDING MAINTENANCE AND OPERATION

☐ **5.410.1 Recycling by occupants.** Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste, and metals or meet a lawfully enacted local recycling ordinance, if more restrictive.

Exception: Rural jurisdictions that meet and apply for the exemption of Public Resources Code 42649.82 (a)(2)(A) et seq. will also be exempt from the organics waste portion of this section.

☐ **5.410.1.2 Sample ordinance.** Space allocation for recycling areas shall comply with Chapter 18, Part 3, Division 30 of the *Public Resources Code.* Chapter 18 is known as the California Solid Waste Reuse and Recycling Access Act of 1991 (Act).

Note: A sample ordinance for use by local agencies may be found in Appendix A of the document at the CalRecycle's website.

DIVISION 5.5 ENVIRONMENTAL QUALITY

SECTION 5.504.1 – POLLUTANT CONTROL

☐ **5.504.3 Covering of duct openings and protection of mechanical equipment during construction.** 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.

5.504.4 Finish material pollutant control. Finish materials shall comply with Sections 5.504.4.1 through 5.504.4.6.

☐ **5.504.4.1 Adhesives, sealants, and caulks.** Adhesives, sealants, and caulks used on the project shall meet the requirements of the following standards:

1. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products as specified in subsection 2, below.
2. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of *California Code of Regulations*, Title 17, commencing with Section 94507.

TABLE 5.504.4.1 – ADHESIVE VOC LIMIT
(See CALGreen for TABLE)

TABLE 5.504.4.2 – SEALANT VOC LIMIT
(See CALGreen for TABLE)

☐ **5.504.4.3 Paints and coatings.** Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 5.504.4.3, shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources Board, Suggested Control Measure, and the corresponding Flat, Nonflat or Nonflat-High Gloss VOC limit in Table 5.504.4.3 shall apply.

TABLE 5.504.4.3 – VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS
(See CALGreen for TABLE)

☐ **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.

5.504.4.3.2 Verification. Verification of compliance with this section shall be provided at the request of the enforcing agency. Documentation may include, but is not limited to, the following:

1. Manufacturer's product specification.

2. Field verification of on-site product containers.

☐ **5.504.4.4 Carpet systems.** All carpet installed in the building interior shall meet at least one of the following testing and product requirements:

1. Carpet and Rug Institute's Green Label Plus Program;
2. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version1.1, February 2010 (also known as CDPH Standard Method V1.1 or *Specification 01350*);
3. NSF/ANSI 140 at the Gold level or higher;
4. Scientific Certifications Systems Sustainable Choice; or
5. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria 2014 and listed in the CHPS High Performance Product Database.

☐ **5.504.4.4.1 Carpet cushion.** All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute's Green Label program**.**

☐ **5.504.4.4.2 Carpet adhesive.** All carpet adhesive shall meet the requirements of Table 5.504.4.1.

☐ **5.504.4.5 Composite wood products.** 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 Table 5.504.4.5.

TABLE 5.504.4.5 – FORMALDEHYDE LIMITS
(See CALGreen for TABLE)

☐ **5.504.4.6 Resilient flooring systems.** For 80 percent of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following:

1. Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program;
2. Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010;
3. Compliant with the Collaborative for High Performance Schools California (CA-CHPS) Criteria 2014 and listed in the CHPS High Performance Product Database; or
4. Products certified under the UL GREENGUARD Gold (formerly the Greenguard Children & Schools program).

☐ **5.504.5.3 Filters.** 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.

Exception: Existing mechanical equipment.

5.504.5.3.1 Labeling. Installed filters shall be clearly labeled by the manufacturer indicating the MERV rating.

SECTION 5.505 – INDOOR MOISTURE CONTROL

☐ **5.505.1 Indoor moisture control.** Buildings shall meet or exceed the provisions of *California Building Code*, CCR, Title 24, Part 2, Sections 1202 (Ventilation) and Chapter 14 (Exterior Walls). For additional measures see Section 5.407.2 of this code.

SECTION 5.506 – INDOOR AIR QUALITY

☐ **5.506.1 Outside air delivery.** For mechanically or naturally ventilated spaces in buildings, meet the minimum requirements of Section 120.1 (Requirements for Ventilation) of the *California Energy Code*, or the applicable local code, whichever is more stringent, and Division 1, Chapter 4 of CCR, Title 8.

SECTION 5.507 – ENVIRONMENTAL COMFORT

☐ **5.507.4 Acoustical control.** 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 Section 5.507.4.1 or 5.507.4.2.

Exception: 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.

Exception: [DSA-SS] For public schools and community colleges, the requirement of this section and all subsections apply only to new construction.

☐ **5.507.4.1 Exteriors noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 in the following locations:

1. Within the 65 CNEL noise contour of an airport.

   Exceptions:

   1. L_{dn} or CNEL for military airports shall be determined by the facility Air Installation Compatible Land Use Zone (AICUZ) plan.
   2. L_{dn} or CNEL for other airports and heliports for which a land use plan has not been developed shall be determined by the local general plan noise element.

2. Within the 65 CNEL or L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway source as determined by the Noise Element of the General Plan.

☐ **5.507.4.1.1 Noise exposure where noise contours are not readily available.** Buildings exposed to a noise level of 65 dBL_{eq}-1-hr during any hour of operation shall have building, addition or alteration exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum STC of 40 (or OITC 30).

☐ **5.507.4.2 Performance method.** For buildings located as defined in Section 5.507.4.1 or 5.507.4.1.1, wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (L_{eq} -1Hr) of 50 dBA in occupied areas during any hour of operation.

☐ **5.507.4.2.1 Site features.** Exterior features such as sound wall or earth berms may be utilized as appropriate to the building, addition or alteration project to mitigate sound migration to the interior.

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☐ **5.507.4.2.2. Documentation of compliance.** An acoustical analysis documenting complying interior sound levels shall be prepared by personnel approved by the architect or engineer of record.

☐ **5.507.4.3 Interior sound transmission.** Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.

Note: Examples of assemblies and their various STC rating may be found at the California Office of Noise Control: www. https://www.tsib.org/files/STC_IIC_Ratings.pdf

SECTION 5.508 – OUTDOOR AIR QUALITY

5.508.1 Ozone depletion and greenhouse gas reductions. Installations of HVAC, refrigeration and fire suppression equipment shall comply with Sections 5.508.1.1 and 5.508.1.2.

☐ **5.508.1.1 Chlorofluorocarbons (CFCs).** Install HVAC, refrigeration and fire suppression equipment that do not contain CFCs.

A DSA Project Submittal Guideline is a compilation of recommendations based on code, referenced standards, DSA bulletin/policy/procedure/interpretation documents, and DSA practices. These guidelines are intended to give the design profession helpful information and insight into DSA's project application, submittal, and review processes. Guidelines are provided by DSA in support of DSA's goals of providing stakeholders information they need to facilitate working smoothly with DSA, and to help standardize practices among the four DSA Regional Offices.

Compliance with a Guideline does not assure that a project is complete or that it adheres to the requirements of the California Building Standards Code (Title 24 of the California Code of Regulations) or all DSA requirements. Additional information may be required, depending on project complexity or site conditions. For complete submittal requirements see forms *DSA 1: Application for Approval of Plans and Specifications* and *DSA 3: Project Submittal Checklist.*