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WINE EDUCATION CENTER
NAPA VALLEY COLLEGE

PROJECT MANUAL

PROJECT ADDRESS
2277 Napa Vallejo Hwy
Napa, CA 94558

OWNER
NAPA VALLEY COLLEGE

DATE
APRIL 12, 2023

TLCD PROJECT NUMBER
21062.00

DSA APPLICATION NUMBER:
01-120890

PROJECT MANUAL

Napa Valley College
Wine Education Center
2277 Napa Vallejo Hwy
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April 12, 2023

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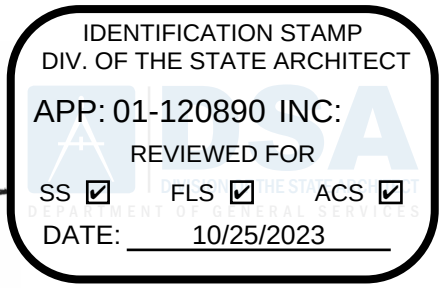
Napa Valley College
Wine Education Center

Napa, California

STAMPS, SIGNATURES AND APPROVALS



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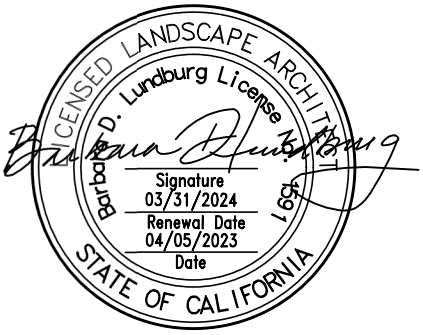

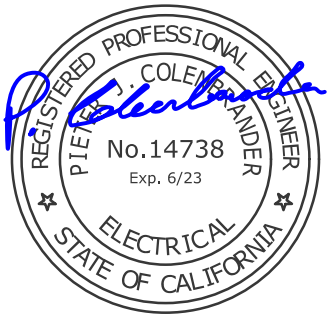

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END OF SECTION

SECTION 00 72 00

GENERAL CONDITIONS

1 GENERAL CONDITIONS

A. The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, Articles 1 through 15 inclusive, is a part of this Contract, and is incorporated herein as fully as if here set forth.

1. A copy of the General Conditions may be obtained at www.aia.org under “Contract Documents”, bottom of page “Store”; by calling 800-242-3837 (option 4); or at www.aiasf.org under “Publications”.

END OF SECTION

SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

1.1 REFERENCE TO DIVISION 1 - GENERAL REQUIREMENTS

A. Where provisions of General Conditions relate to Project administration or work-related requirements of the Contract, those paragraphs are expanded in Division 01 - General Requirements of the Specifications.

B. General Conditions, Supplementary Conditions and Division 01 - General Requirements contain information necessary for completion of every part of Project.

1. Where items of Work are done under subcontracts, each item shall be subject to these conditions.

1.2 SUPPLEMENTS

A. The following supplements modify, change, delete from or add to General Conditions of the Contract as indicated in Section 00 72 00 - General Conditions.

B. Where any part of the General Conditions is modified or deleted by these supplements, unaltered provisions of the modified article, paragraph, subparagraph or clause shall remain in effect.

1.3 ARTICLE 1: GENERAL PROVISIONS

ADD to 1.1 the following definitions:

1.1.9 **Approved:** The terms approved, directed, selected, required, ordered, designated, accepted, acceptable and satisfactory shall require written action by Architect.

1.1.10 **Equal, Approved Equal:** The terms equal and approved equal shall require requests for substitutions for products or manufacturers not specified; requests for substitutions shall be in accordance with requirements of Section 01 25 00 – Substitution Procedures.

1.1.11 **Furnish:** The term furnish means supply and deliver to Project, unless otherwise defined in greater detail.

1.1.12 **Install:** The term install is used to describe operations at Project, from inspecting and unloading, to completion in place, ready for intended use.

1.1.13 **Provide:** The term provide means furnish and install, complete and ready for intended use, unless otherwise defined in greater detail.

ADD the following to Subparagraph 1.2.1:

1.2.1.2 **Inconsistencies:** In case of an inconsistency between Drawings and Specifications or within other Contract Documents not clarified by addendum, provide better quality or greater quantity of Work in accordance with Architect's interpretation.

1.2.1.3 **Manufacturer Options:** Where manufacturer’s offer options for specified products and Contract Documents do not list specific options, provide for best options available and appropriate to applications indicated and clearly indicate options to be selected by Architect with Product Data submittals.

ARTICLE 3: CONTRACTOR

ADD the following to Subparagraph 3.4.2:

3.4.2.1 **Substitutions:** After Contract has been executed, the Owner and Architect will consider formal requests for substitution of products in place of those specified only under conditions set forth in Section 01 25 00 – Substitution Procedures.

ARTICLE 5: SUBCONTRACTS

ADD the following to Paragraph 5.3:

5.3.1 **Materials Suppliers:** For purposes of this Contract materials suppliers shall be considered a Subcontractor regardless of whether they perform their portion of the Work at the site.

ARTICLE 9: PAYMENTS AND COMPLETION

ADD the following to 9.3.2.

9.3.2.1 **Stored Materials:** Payments for materials stored off-site will be made, subject to Owner's approval, if Contractor provides invoice, lien release, certificate of insurance covering stored materials, and stores material in approved, bonded warehouse.

ARTICLE 11: INSURANCE AND BONDS

ADD the following to Subparagraph 11.1.2:

11.1.2.1 **Insurance Amounts:** Amount of insurance shall be as approved by Owner. When additional insurance is required, Owner reserves right to negotiate difference in cost directly with Contractor's Insurance Carrier.

ADD the following to 11.1.3:

11.1.3.1 **Certificate of Insurance:** Furnish one copy of each Certificate of Insurance required for each copy of Agreement.

11.1.3.1.1 Form of certificate shall be an approved certificate which specifically sets forth evidence of all coverage required.

11.1.3.1.2 Furnish to Owner copies of any endorsements subsequently issued amending coverage or limits.

11.1.3.2 Upon receipt of any notice of cancellation or alteration, Contractor shall, within five days, procure other policies of insurance similar in all respects to policy or policies about to be canceled or altered.

11.1.3.2.1 If Contractor fails to provide acceptable policies of insurance, Owner may obtain such insurance at cost and expense of Contractor.

ADD to 11.1.2 the following bond requirements:

11.1.2.1 **Bonds Values:** Provide 100 percent Performance Bond and Payment Bond using AIA Document A312 Performance Bond and Payment Bond, or an approved similar bond.

END OF SECTION

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Owner-furnished/Contractor-installed (OFCI) products.
5. Contractor's use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.
9. Miscellaneous provisions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01 73 00 "Execution" for coordination of Owner-installed products.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Project Identification: Napa Valley College Wine Education Center.

1. Project Location: 2277 Napa Vallejo Hwy, Napa, California, 94558, United States.

a. Items noted "NIC" (Not in Contract) will be furnished and installed by Owner or under separate contract.
b. Hazardous Materials Removal: Where materials suspected as being hazardous are encountered, inform Owner immediately. Work directly with Owner relating to hazardous materials.
   1) Architect shall not be involved in determination, removal, or disposal of hazardous materials.
c. Owner reserves right to remove and retain possession of existing items prior to start of Contract.

B. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1. See Section 01 31 00 "Project Management and Coordination." for requirements for using web-based Project software.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

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

1. Demolition of two existing buildings (one modular, one wood framed), and the construction of a new building, associated site work, and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.6 PHASED CONSTRUCTION

A. Construct the Work in phases, with each phase substantially complete as indicated on Drawings.

1.7 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
   a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. As indicated on the Drawings.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

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

B. Limits on 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. Limits on Use of Site: Confine construction operations to the area or areas designated by the Owner prior to beginning of construction operations.
2. 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 for 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.

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

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

1.10 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work to the hours and days established by the Owner at the Preconstruction Meeting, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

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 arranging for temporary utility services according to requirements indicated:

1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
2. Obtain Construction Manager's written permission before proceeding with utility interruptions.

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

1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.
2. Obtain Construction Manager's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property 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 and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 25 00

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 Requirements:

1. Document 00 26 00 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
2. Section 01 21 00 "Allowances" for products selected under an allowance.
3. Section 01 23 00 "Alternates" for products selected under an alternate.
4. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

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 or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION 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 acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions 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 substitutions 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. Cost information, including a proposal of change, if any, in the Contract Sum.
h. 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.
i. 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 seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: 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.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 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.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 01 31 00 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on web-based Project management software.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Construction Manager 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. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
2. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

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

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.

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 Section 01 25 00 "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.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Construction Manager may issue a Construction Change Directive on form provided as part of web-based Project management software. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction 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.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction 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 items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect through Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

B. Format and Content: Use 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. Owner's name.
   c. Owner's Project number.
   d. Name of Architect.
   e. Architect's Project number.
   f. Contractor's name and address.
   g. 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. Round dollar amounts to whole dollars, with total equal to Contract Sum.
      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. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. 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.
5. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
6. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

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 Construction Manager and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 AIA Document G703 and AIA Document G732 EJCDC Document C-620 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor may be acceptable to Construction Manager and Owner. 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. Construction Manager 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. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager 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 lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

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 executed waivers of lien on forms 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. Products list (preliminary if not final).
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 77 00 "Closeout Procedures."
2. This application shall reflect Certificate(s) of 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. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.
10. Proof that taxes, fees, and similar obligations are paid.
11. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

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.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally 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.

1. 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:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

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

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches 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.
8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. 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.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

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

1. File Preparation Format:
   a. Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using PDF format.
3. 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 Autocad .dwg format and/or PDF format.
   c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, 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 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. Owner name.
3. Owner's Project number.
4. Name of Architect and Construction Manager.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.

11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. 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 Forms: As generated from Web-based Project management software package.

1. Attachments shall be electronic files in PDF format.

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

1. The following Contractor-generated 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.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architectof additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly . Use software log that is part of web-based Project management software. Software log with not less than 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.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

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

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Autocad .dwg format.
4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
    a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
5. The following digital data files will be furnished for each appropriate discipline:
    a. Floor plans.
    b. Reflected ceiling plans.

B. Web-Based Project Management Software Package: web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:
    a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.
    d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    e. Track status of each Project communication in real time, and log time and date when responses are provided.
    f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    g. Processing and tracking of payment applications.
    h. Processing and tracking of contract modifications.
    i. Creating and distributing meeting minutes.

j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to Project management software user licenses for use of Owner , Architect, and Architect's consultants. Provide hours of software training at Architect's office for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority,, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Responsibilities and personnel assignments.

b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Designation of key personnel and their duties.
f. Lines of communications.
g. Use of web-based Project software.
h. Procedures for processing field decisions and Change Orders.
i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Preparation of Record Documents.
o. Use of the premises.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Construction waste management and recycling.
w. Parking availability.
x. Office, work, and storage areas.
y. Equipment deliveries and priorities.
z. First aid.
aa. Security.
bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager, and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Sustainable design requirements.
   i. Review of mockups.
   j. Possible conflicts.

k. Compatibility requirements.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of Record Documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Procedures for completing and archiving web-based Project software site data files.
   d. Submittal of written warranties.
   e. Requirements for completing sustainable design documentation.
   f. Requirements for preparing operations and maintenance data.
   g. Requirements for delivery of material samples, attic stock, and spare parts.
   h. Requirements for demonstration and training.
   i. Preparation of Contractor's punch list.
   j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   k. Submittal procedures.

l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.
      4) Deliveries.
      5) Off-site fabrication.
      6) Access.
      7) Site use.
      8) Temporary facilities and controls.
      9) Progress cleaning.
      10) Quality and work standards.
      11) Status of correction of deficient items.
      12) Field observations.
      13) Status of RFIs.
      14) Status of Proposal Requests.
      15) Pending changes.
      16) Status of Change Orders.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of RFIs.
        14) Proposal Requests.
        15) Change Orders.
        16) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Site condition reports.
6. Unusual event reports.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
2. Section 01 40 00 "Quality Requirements" for schedule of tests and inspections.

1.2 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 the critical path of Project and when activities can be performed.

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. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

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

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

E. Daily Construction Reports: Submit at monthly intervals.

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

G. Unusual Event Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

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.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.

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

C. Activities: Treat each floor 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. Temporary Facilities: Indicate start and completion dates for the following as applicable:
   a. Securing of approvals and permits required for performance of the Work.
   b. Temporary facilities.
   c. Construction of mock-ups, prototypes and samples.
   d. Owner interfaces and furnishing of items.
   e. Interfaces with Separate Contracts.
   f. Regulatory agency approvals.
   g. Punch list.
3. Procurement Activities: Include procurement process activities for the following long lead-time 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.
4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

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

1. Phasing: Arrange list of activities on schedule by phase.
2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "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 Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use-of-premises restrictions.
   f. Provisions for future construction.

g. Seasonal variations.
h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   a. Subcontract awards.
   b. Submittals.
   c. Purchases.
   d. Mockups.
   e. Fabrication.
   f. Sample testing.
   g. Deliveries.
   h. Installation.
   i. Tests and inspections.
   j. Adjusting.
   k. Curing.
   l. Building flush-out.
   m. Startup and placement into final use and operation.
   n. Commissioning.
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.

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

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 the Contract Time.

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

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates 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.

H. 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, equipment required to achieve compliance, and date by which recovery will be accomplished.

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

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

1.6 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.7 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.8 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit 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.

C. Unusual Event Reports: 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, responses 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 unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action 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 revisions to submittals noted by Architect and Construction Manager 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 Schedule: Submit concurrently with startup 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 Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule as required 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. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's and Construction Manager's final release or approval.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.

16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. 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 and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
    a. Architect , through Construction Manager, will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. 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 transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. 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 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.

D. 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 and Construction Manager's action stamp.

E. 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.

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

1.7 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. Notation of coordination requirements.
    g. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:

a. 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.

C. Samples: Submit Samples for review of type, 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. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
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 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(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect , through Construction Manager, 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 sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
   1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
   2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. 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 substrate preparation and primers required.
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.

1.8 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action.
2. Submittals by Web-Based Project Management Software: Architect and Construction Manager will indicate, on Project management software website, the appropriate action.

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

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Architect and Construction Manager will return without review submittals received from sources other than Contractor.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

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

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

C. Related Requirements:

1.2 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. 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.

E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with 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.

F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

H. 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.

I. 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 or Construction Manager.

1.3 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is 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.

1.4 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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 inspection.
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. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. 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 of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. 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 of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.5 QUALITY ASSURANCE

A. 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

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

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

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1.6 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

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. Engage a qualified testing agency to perform quality-control services.
   a. Contractor will 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 inspection 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 inspection 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.

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

1. Notify Architect , Construction Manager, 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 and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through 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.

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

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

D. 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.

1. 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.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.7 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect , Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect , through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

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, Commissioning Authority's, and Construction Manager's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "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 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 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.

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.

1.2 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.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

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.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (see FGIA).
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; www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.
24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyzeseeds.com.

25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International;
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; www.bwfbadminton.com.
50. CARB - California Air Resources Board; www.arb.ca.gov.
51. CDA - Copper Development Association Inc.; www.copper.org.
52. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
53. CEA - Canadian Electricity Association; www.electricity.ca.
54. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
55. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
56. CGA - Compressed Gas Association; www.cganet.com.
57. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
58. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
59. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
60. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
61. CPA - Composite Panel Association; www.compositepanel.org.
62. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
63. CRRC - Cool Roof Rating Council; www.coolroofs.org.
64. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
65. CSA - CSA Group; www.csagroup.org.
66. CSI - Cast Stone Institute; www.caststone.org.
67. CSI - Construction Specifications Institute (The); www.csiresources.org.

68. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
69. CTA - Consumer Technology Association; www.cta.tech.
70. CTI - Cooling Technology Institute; www.coolingtechnology.org.
71. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
72. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
73. DHI - Door and Hardware Institute; www.dhi.org.
74. ECIA - Electronic Components Industry Association; www.ecianow.org.
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
78. ESTA - Entertainment Services and Technology Association; www.esta.org.
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FGIA - Fenestration and Glazing Industry Alliance; https://fgiaonline.org.
82. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
83. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
84. FM Approvals - FM Approvals LLC; www.fmapprovals.com.
85. FM Global - FM Global; www.fmglobal.com.
86. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
87. FSA - Fluid Sealing Association; www.fluidsealing.com.
88. FSC - Forest Stewardship Council U.S.; www.fscus.org.
89. GA - Gypsum Association; www.gypsum.org.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
93. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
94. IAS - International Accreditation Service; www.iasonline.org.
95. ICC - International Code Council; www.iccsafe.org.
96. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
97. ICPA - International Cast Polymer Association (The); www.theicpa.com.
98. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
99. IEC - International Electrotechnical Commission; www.iec.ch.
100. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
101. IES - Illuminating Engineering Society; www.ies.org.
102. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
103. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
104. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
105. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
106. Intertek - Intertek Group; www.intertek.com.
107. ISA - International Society of Automation (The); www.isa.org.
108. ISFA - International Surface Fabricators Association; www.isfanow.org.
109. ISO - International Organization for Standardization; www.iso.org.
110. ITU - International Telecommunication Union; www.itu.int.
111. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
112. LPI - Lightning Protection Institute; www.lightning.org.

113. MBMA - Metal Building Manufacturers Association; www.mbma.com.
114. MCA - Metal Construction Association; www.metalconstruction.org.
115. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
116. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
117. MHI - Material Handling Industry; www.mhi.org.
118. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
119. MPI - Master Painters Institute; www.paintinfo.com.
120. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
121. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
122. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
123. NADCA - National Air Duct Cleaners Association; www.nadca.com.
124. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
125. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
126. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
127. NBI - New Buildings Institute; www.newbuildings.org.
128. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
129. NCMA - National Concrete Masonry Association; www.ncma.org.
130. NEBB - National Environmental Balancing Bureau; www.nebb.org.
131. NECA - National Electrical Contractors Association; www.necanet.org.
132. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
133. NEMA - National Electrical Manufacturers Association; www.nema.org.
134. NETA - InterNational Electrical Testing Association; www.netaworld.org.
135. NFHS - National Federation of State High School Associations; www.nfhs.org.
136. NFPA - National Fire Protection Association; www.nfpa.org.
137. NFPA - NFPA International; (see NFPA).
138. NFRC - National Fenestration Rating Council; www.nfrc.org.
139. NGA - National Glass Association; www.glass.org.
140. NHLA - National Hardwood Lumber Association; www.nhla.com.
141. NLGA - National Lumber Grades Authority; www.nlga.org.
142. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
143. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
144. NRCA - National Roofing Contractors Association; www.nrca.net.
145. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
146. NSF - NSF International; www.nsf.org.
147. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
148. NSPE - National Society of Professional Engineers; www.nspe.org.
149. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
150. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
151. NWFA - National Wood Flooring Association; www.nwfa.org.
152. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
153. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
154. PDI - Plumbing & Drainage Institute; www.pdionline.org.
155. PLASA - PLASA; www.plasa.org.
156. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.

157. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; (see WWPA).
161. SAE - SAE International; www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
167. SIA - Security Industry Association; www.securityindustry.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.
169. SMA - Screen Manufacturers Association; www.smainfo.org.
170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
178. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.
179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
184. TIA - Telecommunications Industry Association (The); www.tiaonline.org.
185. TMS - The Masonry Society; www.masonrysociety.org.
186. TPI - Truss Plate Institute; www.tpinst.org.
187. TPI - Turfgrass Producers International; www.turfgrasssod.org.
188. TRI - Tile Roofing Industry Alliance; www.tileroofing.org.
189. UL - Underwriters Laboratories Inc.; www.ul.org.
190. UL LLC - UL LLC; www.ul.com.
191. USAV - USA Volleyball; www.usavolleyball.org.
192. USGBC - U.S. Green Building Council; www.usgbc.org.
193. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
194. WA - Wallcoverings Association; www.wallcoverings.org.
195. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
196. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
197. WDMA - Window & Door Manufacturers Association; www.wdma.com.
198. WI - Woodwork Institute; www.woodworkinstitute.com.
199. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
200. WWPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to 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 are to 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. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.
5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.
8. FAA - Federal Aviation Administration; www.faa.gov.
9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to 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 U.S. Government Publishing Office; www.govinfo.gov.
2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
3. DSCC - Defense Supply Center Columbus; (see FS).
4. FED-STD - Federal Standard; (see FS).

5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
   a. Available from Defense Standardization Program; www.dsp.dla.mil.
   b. Available from U.S. General Services Administration; www.gsa.gov.
   c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
6. MILSPEC - Military Specification and Standards; (see DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to 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. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; https://tfsweb.tamu.edu/.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

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

D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

1.4 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide bases for supporting posts.

B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

C. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

2.2 TEMPORARY FACILITIES

A. Field Offices:

1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to

accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

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

1. Store combustible materials apart from building.

2.3 EQUIPMENT

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

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.

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

3.2 INSTALLATION, GENERAL

A. Locate facilities 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.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

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

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
2. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

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. Water Service:

1. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

D. Temporary 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. Electric Power Service:

1. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
   a. Connect temporary service to Owner's existing power source, as directed by Owner.

F. 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.

G. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

H. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Core i5 or i7.
2. Memory: 16 gigabyte.
3. Disk Storage: 1 -terabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 24-inch LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows 10 Professional.
8. Productivity Software:
   a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
   b. Adobe Reader DC.
   c. WinZip 10.0 or higher.
9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0 -Mbps upload and 15 -Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 2 terrabytes, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
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. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 31 20 00 "Earthwork."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

D. 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.

E. Parking: parking areas for construction personnel.

F. Storage and Staging: for storage and staging needs.

G. Dewatering Facilities and Drains: 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.
2. Remove snow and ice as required to minimize accumulations.

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

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touch up signs, so they are legible at all times.

I. Waste Disposal Facilities:

1. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

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.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

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 Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control:

1. Comply with requirements specified in Section 31 10 00 "Site Preparation."
2. 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, in accordance with .
    a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
    b. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
    c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
    d. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

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

E. Tree and Plant Protection:

1. Comply with requirements specified in Section 01 56 39 "Temporary Tree and Plant Protection."

F. Site Enclosure Fence: , furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As determined with Owner at Preconstruction Conference. Contractor to submit fence layout plan for approval prior to start of work.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

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

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: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

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

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: 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 Period: 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 and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: 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 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

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. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes: General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for temporary controls, utilities, support facilities, temporary site fencing, and, if applicable, temporary erosion and sedimentation controls if not specified in Section 311000 "Site Clearing".
2. Section 31 10 00 "Site Preparation" for removing existing trees and shrubs and for temporary erosion- and sedimentation-control measures if not specified in Section 01 50 00 "Temporary Facilities and Controls".

1.2 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
   a. Tree-service firm's personnel and equipment needed to make progress and avoid delays.

b. Arborist's responsibilities.
c. Quality-control program.
d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.
f. Field quality control.

1.4 ACTION SUBMITTALS

A. Product Data:

1. General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction

B. Tree-Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Mitigation Requirements: As required by jurisdiction or as developed by arborist, for mitigation of damage to trees and other plantings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction in accordance with recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.6 QUALITY ASSURANCE

A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.

B. Tree-Service Firm Qualifications: An experienced tree-service firm that has successfully completed temporary tree- and plant-protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1.7 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. Take precautions to protect plants from airborne contaminants, such as paint or fireproofing overspray.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Mixture: Well-blended mix of 2 parts stockpiled soil to 1 part planting soil.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Wood and bark chips.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.
   a. Height: 48 inches.
   b. Color: High-visibility orange, nonfading.
2. Gates: Single- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated . Flag each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE PROTECTION

A. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.
2. Install temporary root-protection matting over mulch to the extent indicated.

3.4 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
2. Access Gates: Install where directed by Owner if required; adjust 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. Plastic Fencing: Stretch fabric taut and secure to posts without bows or sags.

B. Maintain protection zones free of weeds and trash.

C. Maintain hydration of plants to assure plant survival.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.5 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones in accordance with requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

3.6 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends.
3. Temporarily support and protect roots from damage until they are permanently covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible in accordance with requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.

2. Perform repairs of damaged trunks, branches, and roots within 24 hours in accordance with arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Large Trees: Provide one new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
   a. Species: As selected by Architect.
2. Plant and maintain new trees as specified in Section 32 90 00 "Plants."

C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 ft. beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

END OF SECTION

SECTION 01 57 23

TEMPORARY STORMWATER POLLUTION CONTROL

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. Temporary stormwater pollution controls.

1.3 STORMWATER POLLUTION PREVENTION PLAN

A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, and earthwork subcontractor.
2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPP): Within 15 days of date established for commencement of the Work, submit completed SWPPP.

B. Inspection reports.

1.6 QUALITY ASSURANCE

A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.

1. SWPPP Coordinator shall complete and finalize the SWPPP form.
2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.

B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.

B. Locate stormwater pollution controls in accordance with the SWPPP.

C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.

1. Inspect, repair, and maintain SWPPP controls during construction.
   a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.

D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 01 10 00 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
3. Section 01 42 00 "References" for applicable industry standards for products specified.
4. Section 01 77 00 "Closeout Procedures" for submitting warranties.

1.2 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 that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."

F. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

1.3 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.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but

inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 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 that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
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 and with adequate protection from wind.
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.

8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections are to 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 standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or 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 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 in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "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 meeting 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 Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
   a. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Architect, whose determination is final.

B. Product Selection Procedures:

1. 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.
2. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
   a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "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 Section 01 25 00 "Substitution Procedures" for proposal of product.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes

such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.

3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within days of receipt of request, or days of receipt of additional information or documentation, whichever is later.

1. Architect's Approval of Submittal: . See Section 01 33 00 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 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.
3. Installation.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 01 10 00 "Summary" for coordination of Owner-furnished products , and limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 DEFINITIONS

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

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

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

a. Contractor's superintendent.
b. Trade supervisor responsible for cutting operations.
c. Trade supervisor(s) responsible for patching of each type of substrate.
d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
a. Contractor's superintendent.
b. Professional surveyor responsible for performing Project surveying and layout.
c. Professional surveyor responsible for performing site survey serving as basis for Project design.
2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor .

B. Certified Surveys: Submit two copies signed by land surveyor .

C. Certificates: Submit certificate signed by land surveyor , certifying that location and elevation of improvements comply with requirements.

D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems

that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

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

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional 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. Professional Engineer Qualifications: Refer to Section 01 40 00 "Quality Requirements."

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

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, 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-suppression systems.
   c. Plumbing piping systems.
   d. Mechanical systems piping and ducts.
   e. Control systems.
   f. Communication systems.
   g. Fire-detection and -alarm systems.
   h. Electrical wiring systems.
   i. 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. Equipment supports.
   d. Piping, ductwork, vessels, and equipment.
   e. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in 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.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

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. Use materials that are not considered hazardous.

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.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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, gas service piping, 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. 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 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, submit a request for information to Architect through Construction Manager in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

B. Engage a land surveyor experienced in laying out the Work, using the following 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 and Construction Manager 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 and Construction Manager.

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 or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

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

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

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 satisfactory results as judged by Architect. 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 of type expected for Project.

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: Select tools or equipment that minimize production of excessive 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 portions of the 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 with manufacturer.

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, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

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

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

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

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

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

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 10 00 "Summary."

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

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable 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.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. 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 areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

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

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

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

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 01 10 00 "Summary" for other requirements for Owner-furnished, Contractor-installed products.

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. 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, in accordance with 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 in accordance with 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: 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 Section 01 74 19 "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 ensure 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. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

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

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

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

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

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

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

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

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

B. Related Requirements:

1. Section 31 10 00 "Site Preparation" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

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

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

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.

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

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

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

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

C. 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.

D. 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.

E. Qualification Data: For and .

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

1.7 QUALITY ASSURANCE

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

B. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 01 31 00 "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 each contractor and 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

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

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

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 02 41 10 "Structure Demolition."
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in transportation and tipping fees by donating materials.
7. Savings in transportation and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
   a. Asphalt paving.
   b. Concrete.
   c. Concrete reinforcing steel.
   d. Wood studs.
   e. Wood joists.
   f. Plywood and oriented strand board.
   g. Wood paneling.
   h. Wood trim.
   i. Structural and miscellaneous steel.
   j. Doors and frames.
   k. Windows.
   l. Gypsum board.
   m. Piping.
   n. Mechanical equipment.
   o. Electrical conduit.
   p. Copper wiring.
   q. Lighting fixtures.
   r. Electrical devices.
   s. .
2. Construction Waste:
   a. Lumber.
   b. Wood sheet materials.

c. Wood trim.
d. Metals.
e. Gypsum board.
f. Piping.
g. Electrical conduit.
h. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
   1) Paper.
   2) Aluminum cans.
   3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

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

1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

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

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

C. 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 and recycled.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Comply with requirements in Section 02 41 10 "Structure Demolition" for salvaging demolition waste.

B. Salvaged Items for : Permitted on Project site.

C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

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

E. Plumbing Fixtures: Separate by type and size.

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

G. 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 Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

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

D. Procedures: 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 materials away from construction area. Do not store within drip line of remaining trees.
3. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 31 20 00 "Earthwork" for use as general fill.

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

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

1. Pulverize concrete to maximum 1-1/2-inch size.
2. Crush concrete and screen to comply with requirements in Section 31 20 00 "Earthwork" for use as satisfactory soil for fill or subbase.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. 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.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

M. Conduit: Reduce conduit to straight lengths and store by material and size.

N. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

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. 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 Section 32 90 00 "Plants" 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.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
   a. Comply with requirements in Section 32 90 00 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, 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.

3.7 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-2 for demolition waste identification.

C. Form CWM-7 for construction waste reduction progress report.

D. Form CWM-8 for demolition waste reduction progress report.

END OF SECTION

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

* Insert units of measure.

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

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

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

* * * * *

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Section 01 79 00 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 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: Complete 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 submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. 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 Substantial 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 Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

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, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, 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 and Construction Manager.
    d. Name of Contractor.
    e. Page number.
4. Submit list of incomplete items in the following format:
    a. PDF Electronic File: Architect will return annotated file.
    b. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, 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. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site .

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 Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations 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 certification of Substantial Completion for entire Project or for a designated portion of Project:
    a. Clean Project site 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
    h. Vacuum and mop concrete.

i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
q. Clean strainers.
r. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 01 78 23

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 manuals, 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 Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.

2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: 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. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf 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 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 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.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: 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, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. 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."

1.7 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.

1.8 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.

1.9 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 has 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.

1.10 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, identified by product name and arranged to match manual's 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. Manufacturers' Maintenance Documentation: Include 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.

1.11 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 manual, identified by product name and arranged to match manual's 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 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Product Data.

B. Related Requirements:

1. Section 01 73 00 "Execution" for final property survey.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of Record Drawings as follows:
   a. Initial Submittal:
      1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
      2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
   b. Final Submittal:
      1) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
      2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

C. Reports: Submit written report indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to 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 acceptable 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 photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations.
   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.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
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 through Construction Manager for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
   a. See Section 01 31 00 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
   b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect and Construction Manager.
   e. Name of Contractor.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
   a. Name of Project.
   b. Name and address of videographer.
   c. Name of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Date of video recording.
2. Transcript:
   a. Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, 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. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.
2. Documentation: Review the following items in detail:
    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. 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.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.

1. Submit video recordings on CD-ROM or thumb drive.
2. File Hierarchy: Organize folder structure and file locations in accordance with Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged in accordance with Project Manual table of contents:
    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.
    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.

F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 81 13

SUSTAINABLE DESIGN REQUIREMENTS - CALGREEN NON-RESIDENTIAL MANDATORY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General requirements and procedures for compliance with and certification from 24 CCR 11 (hereafter, "CALGreen").

1. Some CALGreen requirements depend on product selections and may not be specifically identified as CALGreen requirements. Compliance with CALGreen requirements may be used as one criterion to evaluate substitution requests and comparable product requests.

1.2 DEFINITIONS

A. VOCs: Volatile organic compounds.

B. Composite Wood Products: Hardwood plywood, particleboard, and medium-density fiberboard. Composite wood products do not include hardboard, structural plywood.

C. Recycled Content: Component of a material made of recycled materials. Recycled material can be derived from two sources: pre-consumer, also known as "post-industrial," or "post-consumer." "Post-consumer recycled material" refers to items, such as aluminum cans, that have been in the consumer market. Post-industrial material is waste generated from the original manufacturing process that is used again.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submit documentation to enforcing agency for credits that are the responsibility of Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until enforcing agency has made its determination on Project's CALGreen certification application.

1. Document correspondence with review team, as assigned by the enforcing agency, as informational submittals.

B. Environmental Management System: Document the following:

1. Environmental policy.
2. Regulatory compliance and training.
3. Environmental risk assessment that shows sensitive environmental areas and ranks potential risks that may arise from the construction.

4. Environmental risk management strategies.
5. Environmental management roles, responsibilities, and reporting structure for the construction phase.
6. Site and work instructions for site personnel, outlining environmental procedures during construction.
7. Environmental inspection checklists.
8. Records of compliance.

1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Design Action Plans: Submit preliminary submittals within days of date established for indicating how the following requirements will be met:

1. CALGreen checklist for mandatory measures.
2. CALGreen Tier 1 or Tier 2 checklist as required.
3. List of products with environmental product declarations.
4. List of products complying with requirements for multiple-attribute standards.
5. List of products complying with requirements for life-cycle product assessments.
6. Environmental policy.
7. Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
8. Construction IAQ management plan.

B. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide products and procedures necessary to comply with CALGreen requirements referenced in the Evaluations. Although other Sections may specify some requirements that contribute to referenced CALGreen requirements, determine additional materials and procedures necessary to comply with CALGreen requirements indicated.

2.2 LOW-EMITTING MATERIALS

A. Adhesives and Sealants:

1. For field applications inside the building, adhesives and sealants shall comply with the following VOC content limits:
   a. Wood Glues: 30 g/L.
   b. Metal-to-Metal Adhesives: 30 g/L.
   c. Adhesives for Porous Materials (except Wood): 50 g/L.
   d. Subfloor Adhesives: 50 g/L.

e. Plastic Foam Adhesives: 50 g/L.
f. Carpet Adhesives: 50 g/L.
g. Carpet Pad Adhesives: 50 g/L.
h. VCT and Asphalt Tile Adhesives: 50 g/L.
i. Cove Base Adhesives: 50 g/L.
j. Gypsum Board and Panel Adhesives: 50 g/L.
k. Rubber Floor Adhesives: 60 g/L.
l. Ceramic Tile Adhesives: 65 g/L.
m. Multipurpose Construction Adhesives: 70 g/L.
n. Fiberglass Adhesives: 80 g/L.
o. Contact Adhesive: 80 g/L.
p. Structural Glazing Adhesives: 100 g/L.
q. Wood Flooring Adhesive: 100 g/L.
r. Single-Ply Roof Membrane Adhesive: 250 g/L.
s. 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.
t. Plastic Cement Welding Compounds: 250 g/L.
u. ABS Welding Compounds: 325 g/L.
v. CPVC Welding Compounds: 490 g/L.
w. PVC Welding Compounds: 510 g/L.
x. Adhesive Primer for Plastic: 550 g/L.
y. Architectural Sealants: 250 g/L.
z. Nonmembrane Roof Sealants: 300 g/L.
aa. Single-Ply Roof Membrane Sealants: 450 g/L.
bb. Other Sealants: 420 g/L.

2. For field applications inside the building, adhesives and sealants must comply with the requirements of SCAQMD Rule 1168 or local code when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Carpet, cushion, and undercarpet adhesives will comply with CRI's Green Label Plus testing program.

C. Paints: For field applications inside the building, wall paints must comply with local code requirements when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Resilient Flooring: Flooring must be certified by the Resilient Floor Covering Institute and/or be compliant when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Flooring must also comply with the Collaborative for High Performance Schools (CHPS) requirements.

E. Thermal Insulation: Provide insulation complying with CALGreen Tier 1 or 2 requirements.

F. Ceiling and Wall Panels: Acoustical ceiling and wall-cladding products must comply with the VOC emissions limits defined in the CHPS criteria and be listed in the CHPS Pre-Approved Products database or have a Greenguard Certification Program.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

A. CALGreen requires use of a construction waste management plan outlining how waste will be divided on the construction site, as well as how often it will be hauled to a landfill or recycling center and by whom.

B. CALGreen includes a sample plan outlining all specific requirements of the plan.

C. Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.2 COMMISSIONING

A. CALGreen requires commissioning of the building mechanical and electrical systems to ensure proper installation and optimized performance as the building starts to be occupied. It also requires a systematic quality assurance process that spans the entire design and construction process and includes verifying and documenting that building systems and components are planned, designed, installed, tested, operated, and maintained to meet Owner’s project requirements.

3.3 INDOOR-AIR-QUALITY ASSESSMENT

A. Air-Quality Testing:

1. Conduct baseline IAQ testing, after substantial completion of construction and prior to occupancy, in accordance with the EPA's "Testing for Indoor Air Quality - Section 01 81 09."
2. Verify compliance with standards and limits in the EPA's "Testing for Indoor Air Quality - Section 01 81 09."
    a. Carbon monoxide maximum is 9 ppm, not to exceed outdoor levels by 2 ppm.
    b. Formaldehyde maximum is 27 ppb.
    c. Particulates maximum is 50 micrograms per cubic meter.
    d. 4-Phenylcycohexene maximum is 6.5 micrograms per cubic meter.
    e. Total VOC maximum is 300 micrograms per cubic meter.
3. For each sampling point where the maximum concentration limits are exceeded, take corrective action until air samples indicate compliance.
4. For each sampling point where airborne mold and mildew indoor species distribution varies by more than 10 percent from exterior sampling specification, identify source of mold and mildew and remediate with corrective action, then retest until compliant results are attained.

5. If noncompliant test results occur, provide a written report describing source(s) of noncompliant condition(s) and corrective action(s) implemented.

END OF SECTION

SECTION 02 41 10

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Demolish existing construction as required for Project.

1. Remove existing materials and equipment from site.
2. Remove foundations including basement floor slabs.
3. Cap and identify active utilities.

B. Related Sections:

1. Section 01 11 00: Summary of work including hazardous materials requirements.
2. Section 01 50 00: Temporary facilities including barriers and waste management.
3. Section 01 74 10: Waste management.
4. Municipal Authorities: Dismantling, removing, and capping of Municipal utilities.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Do not interfere with use of adjacent buildings; maintain free and safe passage to and from.

2. Prevent movement or settlement of adjacent structures, provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for movement, settlement, damage, or injury.

3. Cease operations and notify Architect immediately if safety of adjacent structures appears to be endangered; take precautions to properly support structures. Do not resume operations until safety is restored.

4. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways, and trees. Assume liability for such movement, settlement or collapse, promptly repair.

5. Obtain permission from adjacent property owners when outriggers, swinging cranes or similar equipment traverse their property.

B. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents for shoring.

C. Scheduling: Do not close or obstruct roadways without permits. Conduct operations with minimum interference to adjacent traffic.

1.3 SUBMITTALS

A. Action Submittals:

1. Submit demolition procedures and operational sequence to ensure Project sequencing is consistent with Owner needs.

B. Informational Submittal:

1. Submit copies of permits and notices authorizing demolition work.
2. Submit copies of certificates of severance of utility services.
3. Submit copies of permit for transport and disposal of debris.

C. Pre-Demolition Photographs: Show conditions of exiting adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.

D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating shoring compliance with code requirements.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to pollution control for construction waste.

1.5 SITE CONDITIONS

A. Structures to be demolished shall be evacuated and their use discontinued before start of work.

B. Arrange and pay for disconnecting or removing, capping, and plugging utility services; disconnect and stub off; notify affected utility company in advance and obtain approval before starting Work.

C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.

D. Maintain access to existing walkways, exits, and adjacent occupied facilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Debris: Maintain possession of materials being demolished except where noted as a material for reinstallation or a material to be retained by Owner. Immediately remove debris from site.

B. Owner Retained Materials: Contact Owner prior to beginning demolition to determine extent of materials to be retained. Carefully remove materials indicated to be retained by Owner; deliver and store where directed.

1. Inventory and record condition of items to be retained by Owner.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Demolish structures and appurtenances in an orderly and careful manner.

1. Tanks: Remove tanks within construction area; pump out buried tanks located outside construction area, fill tanks with sand or fine gravel and cover with fill unless otherwise indicated.

B. Perform demolition in accordance with authorities having jurisdiction.

1. Do not use explosives.

C. Keep work sprinkled to prevent dust; provide hoses and water as required for demolition. Coordinate potential availability of water from existing on-site water sources with Owner; do not use on-site water without prior written approval.

D. Remove demolished materials from site, unless otherwise directed.

1. Burning of materials on site is not permitted.

2. Remove from site, contaminated, vermin infested, or dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.

E. Rough grade areas affected by demolition and leave level to within one percent; maintain grades and contours of site as indicated.

1. Backfill over excavated areas, open pits and holes caused as a result of demolition which exceed excavation limits for project; use approved fill.

F. Remove demolished materials, tools and equipment upon completion of work; leave site in condition acceptable to Architect.

3.2 REPAIR

A. Repair damage to adjacent structures caused as result of demolition.

B. Repair demolition beyond that required for Project.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all formwork as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:

1. Forms, shores, bracing, removal and other operations as necessary for all cast-in-place concrete and masonry placed.
2. Setting and securing anchor bolts and other metal items embedded in concrete into formwork, using materials and layouts furnished and delivered to jobsite as specified under other sections.

B. Related Sections:

1. Pertinent Sections of Division 03 specifying concrete construction.
2. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete foundations and formwork.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19A Concrete.

B. American Concrete Institute (ACI) PRC-347 "Guide to Formwork for Concrete".

C. American Plywood Association (APA) “Concrete Forming Guide”.

D. West Coast Lumberman Inspection Bureau (WCLIB) “Standard Grading Rules for West Coast Lumber”.

E. ACI MNL-066 “ACI Detailing Manual”.

F. ACI SPEC-301 “Specifications for Concrete Construction”.

G. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

1.3 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring and bracing to conform to design and code requirements, resist imposed loads; resultant concrete to conform to required shape, line and dimension.

1.4 SUBMITTALS

A. Limitation of review: Structural Engineer's review will be required only where specifically requested for general architectural applications and features only.

Contractor is responsible for structural stability, load-resisting characteristics and sufficiency of form work design.

1.5 QUALITY ASSURANCE

A. General: All form materials shall be new at start of work. Produce high quality concrete construction. Minimize defects due to joints, deflection of forms, roughness of forms, nonconforming materials, concrete or workmanship.

B. Reuse of Forms: Plywood forms may be reused, if thoroughly cleaned of all dirt, mortar, and foreign materials, and undamaged at edges and contact face. Reuse shall be subject to permission from the Architect without exception, and issued in writing. Reuse of any panel which will produce a blemish on exposed concrete, will not be permitted.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Form Materials:

1. Non-Exposed Surface Formwork Facing: Forms for concrete which is not exposed to view, may be of plywood as specified for exposed surfaces, or square edge 1x nominal Douglas Fir, Construction Grade, S4S.
2. Exposed Surface Formwork Facing:
   a. Forms for all exterior and interior concrete flat surfaces unless otherwise specified as board formed shall be new Douglas Fir Plywood (APA) ply, 5/8-inch, B-B Plyform, Class 1, Exterior Type, oiled and edged and edge-sealed conforming to U.S. Product Standard PS 1 in large sheet sizes to achieve joint patterns shown.
   b. All exposed concrete edges shall be chamfered 3/4" minimum or as noted on the drawings.
3. Exposed Surface Formwork - Special Pattern Form Liner:
   a. Forms for all exterior and interior concrete flat surfaces indicated shall be as designated by Architect.

B. Earth Forms: Allowed, subject to soil standing in excavations without ravel or caving.

C. Form Release Agent: Spray-on compound, not affecting color, bond or subsequent treatment of concrete surfaces. Maximum VOC content shall comply with local requirements and California Green Building Code.

D. Accessories: Types recommended by manufacturers or referenced standards to suit conditions indicated;

1. Anchors, spacers, void in-fill materials: sized to resist imposed loads.
2. Form Ties: Prefabricated rod, flat band, or wire snap ties with 1" break-back or threaded internal disconnecting type with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than 1" to surface.

E. Corner Chamfers and Rustications: Filleted, wood strip or foam type; sizes and shapes as detailed, or 3/4 x 3/4 inch size minimum if not detailed; maximum possible lengths.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the substrate and the conditions under which concrete formwork is to be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates and conditions.

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

3.2 EARTH FORMS

A. If natural soil or compacted fill can be accurately cut and maintained, foundations and grade beams may be poured against earth without forming. Provide positive protection of trench top corners.

B. Maintain earth forms free of water and foreign materials.

3.3 ERECTION – FORMWORK

A. General: Construct formwork in accordance with calculations, and recommendations of ACI PRC-347. Construct forms to the sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in finished structure. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

1. Schedule the work and notify other trades in ample time so that provisions for their work in the formwork can be made without delaying progress of the project. Install all sleeves, pipes, etc. for building services systems, or other work. Secure information about and provide for all openings, offsets, recessed nailing blocks, channel chases, anchors, ties, inserts, etc. in the formwork before concrete placement.
2. Deflection: Formwork and concrete with excessive deflection after concrete placement will be rejected. Excessive deflection is that which will produce visible and noticeable waves in the finished concrete.
3. Measure formwork for wall elevations and submit in writing to the Architect/Engineer prior to placing concrete.

B. Formwork Construction: Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301. Uniform,

substantial and sufficiently tight to prevent leakage of concrete paste, readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Tie, brace, shore, and support to insure stability against pressures from any source, without failure of any component part and without excessive deflection. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

C. Provide all openings, offsets, inserts, anchorages, blocking, and other features of the work as shown or required. See INSERTS, EMBEDDED PARTS, AND OPENINGS for detailed requirements.

D. Warped, checked, or scuffed forms will be rejected.

E. Maintain membranes, reinforcing and other work free of damage; protect with plywood runway boards or other positive, durable means.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Provide fillet and chamfer strips on external corners of exposed locations and as indicated to form patterns in finished work. Extend patterns around corners and into alcoves, on backs of columns and similar locations not otherwise shown.

1. Produce beveled, smooth, solid, unbroken lines, except as otherwise indicated to conform to patterns.
2. Form corners and chamfers with 3/4 inch x 3/4 inch strips, unless otherwise indicated, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer at changes in direction.

H. Unexposed corners may be formed either square or chamfered.

I. Ties and Spreaders: Arrange in a pattern acceptable to the Architect when exposed. Snap-ties may be used except at joints between pours where threaded internal disconnecting type shall be used.

J. Coordinate this section with other sections of work that require attachment of components to formwork.

K. Reglets and Rebates: Accurately locate, size, and form all reglets and rebates required to receive work of other trades, including flashing, frames, and equipment.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not allow excess form coating material to accumulate in the forms or to come into contact with reinforcement or surfaces which will be bonded to fresh concrete.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.

E. Leave no residue or stain on the face of the concrete, nor affect bonding of subsequent finishes or work specified in other sections.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

1. Provide openings in concrete formwork to accommodate work of other sections including those under separate contracts (if any). Size and location of openings, recesses and chases shall be in accordance with the section requiring such items. Accurately place and securely support items to be built into forms.

B. Construction Joints: Construct and locate generally as indicated on Drawings and only at locations approved by Structural Engineer, so as not to impair the strength of the structure. Form keys in all cold joints shown or required.

C. Locate and set in place items that will be cast directly into concrete.

D. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchors, angles, and other items to be embedded in concrete. Set embedded bolts and sleeves for equipment to template and approved shop drawings prepared by trades supplying equipment.

E. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

F. Wood Inserts and Nailers: Provide approved preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required to produce results shown. Wood plugs shall not be used.

G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

H. Piping: Do not embed piping in structural concrete unless locations specifically approved by Structural Engineer.

I. Conduit: Place conduit below slabs-on-grade and only as specifically detailed on structural drawings. Minimum clear distance between conduits shall be 3 diameters. Location shall be subject to Engineer's written approval and shall not impair the strength of the structure.

J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

1. Provide openings for the introduction of vibrators at intervals necessary for proper placement.
2. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

K. Install Form Liner inserts in accordance with manufacturer's recommendations, to produce patterns and textures indicated.

L. Install waterstops in accordance with manufacturer's recommendations to provide continuous waterproof barrier.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Remove all dirt, chips, sawdust, rubbish, water and foreign materials detrimental to concrete.
2. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 FOOTINGS

A. Verify elevations and provide final excavation required for footings prior to placing of concrete.

3.8 SUPPORT STAKES

A. Where required to support formwork, steel stakes located within the concrete placement area shall be sleeved with PVC pipe of as small of size practical to fit the stake. Sleeves shall be filled with grout after removal of stake. Such stakes shall be located no closer than 48 inches on center each way.

B. Wood stakes shall not be used within the area of concrete placement.

3.9 EQUIPMENT BASES

A. Form concrete bases for all mechanical and electrical equipment in accordance with approved shop details furnished by other sections.

B. Sizes and locations as indicated and as required to produce results shown.

C. Provide coved base for all equipment bases placed on concrete slabs.

3.10 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-301.

3.11 FOAM BLOCK FORMWORK

A. Blocks shall be placed on prepared leveling course for level bearing. Place adjacent blocks in tight contact together. Where placed in multiple layers, orient long axis of upper layer at 90° to lower layer, and so forth for subsequent layers. Anchor blocks as required to prevent movement prior to and during concrete placement. Do not expose to hydrocarbons, solvents, or coal tar.

3.12 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

C. Clean and repair surfaces to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

D. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.13 FORM REMOVAL

A. Do not loosen or remove forms before minimum curing period has elapsed without employment of appropriate alternate curing methods, approved by the Architect in writing.

B. Remove forms without damage to the concrete using means to insure complete safety of the structure and without damage to exposed beams, columns, wall edges, chamfers and inserts. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Do not remove forms until the concrete has hardened sufficiently to permit safe removal and the concrete has attained sufficient strength to safely support imposed loads. The minimum elapsed time for removal of forms after concrete has been placed shall be as follows:

1. Walls: 7 days, provided members are not subjected to overhead loads.
2. Retaining Walls: 21 days minimum.
3. Footings: 7 days minimum. If backfilled immediately, side forms may be removed 24 hours after concrete is placed.

D. Durations listed above are minimums and are subject to extension at the sole judgment of the Architect/Engineer.

E. Reshoring: Reshore members where and if required by Formwork Design Engineer.

F. Do not subject concrete to superimposed loads (structure or construction) until it has attained full specified design strength, nor for a period of at least 14 days after placing.

G. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.14 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing steel work for all concrete work as indicated on the drawings and specified herein.
2. Coordinate this work with other work affected by these operations, such as forms, electrical work, mechanical work, structural steel, and concrete.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of Divisions 03 specifying concrete construction.
3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete work.

1.2 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19A Concrete.

B. American Concrete Institute (ACI) SPEC-301 “Specifications for Concrete Construction”.

C. ACI CODE-318 “Building Code Requirements for Structural Concrete and Commentary”.

D. ACI MNL-066 “ACI Detailing Manual”.

E. ASTM International (ASTM) A1064 “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete”.

F. ASTM A615 “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”.

G. ASTM A706 “Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement”.

H. American Welding Society (AWS) D1.4 – “Structural Welding Code – Steel Reinforcing Bars”.

I. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Shop Drawings: Show complete fabrication and placing details of all reinforcing steel. Comply with requirements of ACI MNL-66. Include:

1. Bar sizes and schedules;
2. Shapes of bent bars, layout and spacing of bars, location of splices.
3. Stirrup spacing, arrangements and assemblies,
4. References to Contract Document detail numbers and designations.
5. Wall elevations corresponding to elevations shown in Contract Documents.

D. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

E. Certificates: Submit all certifications of physical and chemical properties of steel for each heat number as manufactured, including location of material in structure as specified below in Article titled QUALITY ASSURANCE. All materials supplied shall be tagged with heat numbers matching submitted Mill Test Report analyses.

F. Samples: Provide to the Owner's Testing laboratory as specified in Article SOURCE QUALITY CONTROL.

1.4 QUALITY ASSURANCE

A. Perform work of this Section in accordance with CRSI DA4, CRSI P1, ACI SPEC-301, and ACI CODE-318.

B. Requirements of Regulatory Agencies, refer to pertinent Sections of Division 01 and CBC.

C. Certification and Identification of Materials and Uses: Provide Owner's Testing Agency with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.

1. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.

2. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each grade of reinforcing and/or heat number in the project (i.e. foundations, walls, etc.).
3. Unidentified Material Tests: Where identification of materials by heat number to mill tests cannot be made, Owner's Testing Agency shall test unidentified materials as described below.

D. Testing and Inspection: Tests and Inspections required by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent Sections of Division 01.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Deliver reinforcement to project site in bundles marked with durable tags indicating heat number, mill, bar size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

C. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: Deformed billet steel bars, ASTM A706 Grade 60 or ASTM A615 Grade 60.

1. All reinforcement to be unfinished.

B. Welded Wire Reinforcement: ASTM A1064.

C. Tie Wire: No. 16 AWG or heavier, black annealed.

D. Concrete Blocks: On-grade conditions only, as required to support reinforcing bars in position.

E. Reinforcing Supports: Plastic or galvanized steel chairs, bolsters, bar supports, or spacers sized and shaped for adequate support of reinforcement and construction loads imposed during concrete placement, meeting ACI and CRSI standards.

1. For use over formwork: Galvanized wire bar type supports complying with CRSI recommendations. Provide plastic tips where exposed to view or weather after removal of formwork. Do not use wood, brick, or other unacceptable materials.

F. Reinforcement Splice Couplers: For use only where specified on drawings. Submit other locations proposed for use to Engineer for review. "L-Series Bar Lock" Coupler Systems for Splicing Reinforcement Bars, UES ER-0319, by Dayton-Superior Corporation.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4), unless specifically shown otherwise. Details not specifically shown or indicated shall conform to SP-066 and specified codes and standards.

1. Accurately shop-fabricate to shapes, bends, sizes, gauges and lengths indicated or otherwise required.
2. Bend bars once only. Discard bars improperly bent due to fabricating or other errors and provide new material; do not re-bend or straighten unless specifically indicated. Rebending of reinforcement in the field is not allowed.
3. Do not bend reinforcement in a manner that will injure or weaken the material or the embedding concrete.
4. Do not heat reinforcement for bending. Heat-bent materials will be rejected.

B. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work.

1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bends or kinks not indicated on Drawings or final shop drawings.
3. Bars with reduced cross-section due to rusting or other cause.

C. Tag reinforcement with durable identification to facilitate sorting and placing.

D. Shop Fusion Welded Stirrup/Tie/Spiral Cages

1. Shop fusion welding of stirrup/tie/spiral cages is permitted to aid in fabrication and handling. The following requirements shall be met.
2. All reinforcing bars receiving weld shall be ASTM A706.
3. Longitudinal holding wires shall be ASTM A1064.
4. Shop welding shall be performed by machines under a continuous, controlled process.
5. Quality control tests shall be performed on shop-welded specimens and the test results shall be available, upon request, to the Architect/Engineer.
6. Tack welding of reinforcing steel is not permitted.
7. Welding of any type shall not occur at 90°, 135°, or 180° bends. Circular ties and spirals may be shop fusion welded outside of areas with 90°, 135°, or 180° hook bends.
8. Longitudinal bars shall not be welded to stirrups/ties/spirals.

2.3 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following:

1. Sampling and Tests of Reinforcing Bars per CBC 1910A.2.
2. Material Testing:
   a. Identified Steel: When samples are taken from bundled steel identified by heat number, matched with accompanying mill analyses as delivered from the mill, Owner's Testing Agency will perform one tensile test and one bend test per each ten tons or fraction thereof for each required size of reinforcing steel.
   b. Unidentified Steel: When identification of materials by heat number matched to accompanying mill analyses cannot be made, perform one tensile test and one bend test per each two and one-half tons or fraction thereof for each required size of reinforcing steel. Tests of unidentified steel shall be performed by the Owner's Testing Agency and costs for these tests shall be paid by the Contractor by deductive change order.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordinate with work of other sections to avoid conflicts or interference. Bring conflicts between reinforcement and other elements to Architect's attention. Resolve conflicts before concrete is placed.

C. Notify Architect, Structural Engineer, and Authority Having Jurisdiction for review of steel placement not less than 48 hours before placing concrete.

3.2 PLACEMENT

A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean bars free of substances which are detrimental to bonding. Maintain reinforcement clean until embedded in concrete.

C. Place reinforcement to obtain the minimum coverages for concrete protection. Do not deviate from required position. Maintain required distance, spacing and clearance between bars, forms, and ground.

D. Location and Support: Provide metal chairs, runners, bolsters, spacers and hangers, as required.

E. Provide additional steel reinforcement as necessary or as directed, to act as spreaders or separators to maintain proper positioning.

F. Tying and Attachment: Securely tie at all intersections and supports with wire. Prevent dislocation or movement during placement of concrete. Direct twisted ends of wire ties away from exposed concrete surfaces.

G. Separate reinforcing from pipes or conduits with approved non-metallic separators. Do not use wood or steel form stakes or reinforcement used as stakes as support for reinforcement.

H. Accommodate placement of formed openings required by other sections.

I. Obstructions:

1. Where obstructions, block-outs, or penetrations (conduits, raceways, ductwork) prevent continuous placement of reinforcement as indicated, provide additional reinforcing as detailed and as directed by the Structural Engineer to supplement the indicated reinforcement around the obstruction.
2. Place additional trim bars, ties, stirrups, or other elements as detailed and as directed at all opening, sleeves, pipes or other penetrations through structural elements.

3.3 REINFORCING SPACING AND COVERAGE

A. Spacing: Do not space bars closer than four (4) diameters of the largest of two adjacent bars, except at bar laps, which shall be placed such that a minimum of 2 bar diameters is clear between bars.

B. Where reinforcing in members is placed in two layers, the distance between layers shall not be less than four bar diameters of the largest bar and the bars in the upper layers shall be placed directly above those in the bottom layer, unless otherwise detailed or dimensioned.

C. Coverage of bars (including stirrups and columns ties) shall be as follows, unless otherwise shown:

1. Footings: 3 inches to any soil face, 2 inches to top.
2. Slabs (on grade): 2 inches to grade face, 1-1/2 inches to top face.
3. Walls: 1-1/2 inches clear to form and 2 inches clear to form at soil face.

3.4 DOWELS, SPLICES, OFFSETS AND BENDS

A. Provide standard reinforcement splices at splices, corners, and intersections by lapping ends, placing bars in contact, and tightly tying with wire at each end. Comply with details shown on structural drawings and requirements of ACI CODE-318.

B. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.

C. Laps of welded wire reinforcement shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.

D. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.

E. Spacing:

1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.
2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.
3. Request Architect/Engineer review prior to placement for all splices not shown on the drawings.

F. Reinforcement Couplers: Install at all locations indicated. Install couplers in accordance with manufacturer's recommendations.

3.5 WELDING

A. No reinforcing shall be welded unless specifically indicated. No reinforcing shall be welded without prior approval of the Structural Engineer and the Authority Having Jurisdiction.

B. Only when so approved for use as noted above, all welding shall conform to AWS D1.4, ACI CODE-318, and CBC 1903A.8 and the following;

1. All welding performed by certified welders.
2. All reinforcement requires preheat prior to welding. All preheat and welding shall be continuously inspected by the Testing Agency.

3.6 MISPLACED REINFORCEMENT

A. Notify Architect/Engineer immediately if reinforcing bars are known to be misplaced after concrete has been placed.

B. Perform no correction or cutting without specific direction. Do not bend or kink misplaced bars.

C. Correct misplaced reinforcing only as directed in writing by the Architect/Engineer. Bear all costs of redesign, new, or additional reinforcing required because of misplaced bars at Contractor's expense.

3.7 FIELD QUALITY CONTROL

A. The Testing Agency as specified in the Article QUALITY ASSURANCE, will inspect the work for conformance to contract documents before concrete placement.
1. Inspection: Provide inspection and verification of installed reinforcement. Confirm that the surface of the rebar is free of form release oil or other coatings.
2. Inspect all preheat and welding activities for steel reinforcement, when these occur.

3. Exception: Non-structural patios, driveways, and sidewalks do not require special inspection.

3.8 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Provide all labor, materials, equipment and services to complete all concrete work required, including, but not limited to, the following:

1. Foundations, slabs-on-ground, walls, and retaining walls.
2. Installation of all bolts, inserts, sleeves, connections, etc. in the concrete.
3. Joint devices associated with concrete work.
4. Miscellaneous concrete elements, including, but not limited to: equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
5. Concrete curing.
6. Coordination with other sections:
   a. Make all preparations and do all work necessary to receive or adjoin other work. Install all bolts and anchors, including those furnished by other sections, into formwork and provide all required blocking.
   b. Install all accessories embedded in the concrete and provide all holes, blockouts and similar provisions necessary for the work of other sections. Provide all patching or cutting made necessary by failure or delay in complying with this requirement at the Contractor's expense.
   c. Coordinate with other sections for the accurate location of embedded accessories.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of Division 03 specifying concrete construction.
3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete.
4. Pertinent sections of other Divisions specifying floor finishes and sealants applied to concrete substrates.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19A Concrete.

B. American Concrete Institute (ACI) PRC-211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete”

C. ACI PRC-213 “Guide for Structural Lightweight-Aggregate Concrete”.

D. ACI SPEC-301 “Specifications for Concrete Construction”.

E. ACI PRC-302.1 “Guide for Concrete Floor and Slab Construction”.

F. ACI PRC-304 “Guide for Measuring, Mixing, Transporting, and Placing Concrete”.

G. ACI PRC-305.1 “Specification for Hot Weather Concreting”.

H. ACI PRC-306.1 “Standard Specification for Cold Weather Concreting”.

I. ACI SPEC-308.1 “Specification for Curing Concrete”.

J. ACI CODE-318 “Building Code Requirements for Structural Concrete and Commentary”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials such as bond breakers, cure/sealer, admixtures, etc. Demonstrate compliance with specified characteristics. Provide samples of items upon request. Submit material certificates for concrete aggregates and cementitious materials. Certificates shall show compliance to applicable ASTM’s, the CBC, and additional requirements stated herein.

D. Mix Designs: Submit Mix Designs for each structural concrete type required for work per requirements of articles CONCRETE MIXES and QUALITY ASSURANCE. Resubmit revised designs for review if original designs are adjusted or changed for any reason. Non-Structural mixes need not be submitted for review by Structural Engineer.

E. Shop Drawings: Proposed location of construction and cold joints. Proposed location of all slab construction/dowel joints, control joints, and blockouts.

F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

G. Batch Plant Ticket: Include with delivery of each load of concrete. Provide ticket to the Testing Agency and the Architect/Engineer as separate submittals. Concrete delivered to the site without such ticket shall be rejected and returned to the plant. Each ticket shall include all information specified in Article SOURCE QUALITY CONTROL below.

H. Engineering Analysis: Prepared by a California-licensed Civil or Structural Engineer, justifying construction-imposed loads on slabs, beams, and walls which exceed those allowed by CBC for the specified use.

1. 2000 lbs maximum allowable construction load without analysis.
2. 10,000 lbs maximum allowable construction load with analysis.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.4 QUALITY ASSURANCE

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

B. Concrete construction verification and inspection to conform to CBC 1705A.3.

C. Common Sourcing: Provide each of the following materials from consistent sources for entire project.

1. Cement.
2. Fly ash.
3. Aggregate.
4. Slag Cement.

D. Follow requirements of ACI SPEC-305.1 when concreting during hot weather. Follow requirements of ACI SPEC-306.1 when concreting during cold weather.

E. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:

1. Perform tests and inspections specified below in articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and reports to be in conformance with pertinent Sections of Division 01.

F. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in unbroken packages bearing manufacturer's label and shall be brand specified or an approved equal.

B. Delivery, Handling and Storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather or other damage. Sort to prevent inclusion of foreign materials.

D. Specific Requirements:

1. Cement: Protect against dampness, contamination, and warehouse set. Store in weather tight enclosures.
2. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stock pile.
3. Admixtures:
   a. Store to prevent contamination, evaporation, or damage.
   b. Protect liquid admixtures from freezing and extreme temperature ranges.
   c. Agitate emulsions prior to use.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather (Freezing or near-freezing temperatures) per ACI SPEC-306.1:

1. Heat concrete materials before mixing, as necessary to deposit concrete at a temperature of at least 50°F but not more than 90°F.
2. Do not place concrete during freezing, near-freezing weather, snow, rain or sleet unless protection from moisture and/or cold is provided.
3. Protect from freezing and maintain at a temperature of at least 50°F for not less than seven days after placing. Take special precautions to protect transit-mixed concrete.
4. No salts, chemical protection or admixture are permitted without written approval of Architect/Engineer.
5. Contractor shall maintain an air temperature log for the first 7 days after placement with entry intervals not to exceed 8 hours.

B. Hot Weather per ACI SPEC-305.1:

1. Cool concrete materials before mixing, or add ice in lieu of mix water as necessary to deposit concrete at a temperature below 85°F.
2. Do not place concrete in hot/windy weather without Architect/ Engineer review of procedures.
3. Provide sunshades and/or wind breakers to protect concrete during finishing and immediate curing operations. Do not place concrete at air temperature exceeding 90°F.
4. Provide modified mix designs, adding retarders to improve initial set times and applying evaporation reducers during hot/windy weather for review by Independent Testing Agency prior to use.

1.7 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 – PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 1000.

2.2 REINFORCEMENT

A. Comply with requirements of Section 03 2000.

2.3 MATERIALS

A. General Requirements: All materials shall be new and best of their class or kind. All materials found defective, unsuitable, or not as specified, will be condemned and promptly removed from the premises.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type II, low alkali.
2. Fly Ash (Pozzolan): ASTM C618, Class F.
3. Slag Cement: ASTM C989, Grade 100 or 120.

C. Concrete Aggregates:

1. Coarse and Fine Aggregates: ASTM C33; Stone aggregate and sand. Specific source aggregate and/or sand or shrinkage characteristics as required for class of concrete specified.
2. Source shall remain constant throughout the duration of the job. The exact portions of the fine aggregates and coarse aggregates to be used in the mix shall be determined by the mix design.
3. Aggregates shall be tested for alkali reactivity per CBC section 1903A.5. Where test results exceed allowable limits, additional testing of mitigation procedures shall be provided, as outlined per CBC section 1903A.5.

D. Water: ASTM C1602. Potable, clean, from domestic source.

E. Admixtures: All admixtures shall be used in strict accordance with the manufacturer's recommendations. Admixtures containing calcium chlorides or other accelerators shall not be used without the approval of the Architect/Engineer and the Owner's Testing Laboratory.

1. Normal or Mid-Range Water Reducing Admixtures: ASTM C494 Type A, “MasterPozzolith” series or "MasterPolyheed" series by Master Builders Solutions, "WRDA" series by W.R. Grace, or equal.
2. Water Reducing Admixture and Retarder: ASTM C494 Type B or D, "MasterSet R" series or “MasterSet DELVO” series by Master Builders Solutions, "Plastiflow-R" by Nox-crete, or equal.
3. High Range Water-Reducing Admixtures: ASTM C494 Type F, "MasterRheoBuild 1000" or “MasterGlenium” series by Master Builders Solutions or equal.
4. Air Entraining Admixtures: ASTM C260, “MasterAir” series by Master Builders Solutions or equal.
5. Viscosity Modifiers: ASTM C494 Type S. “MasterMatrix VMA” series by master Builders Solution or equal.

F. Slurry: Same proportion of cement to fine aggregates used in the regular concrete mix (i.e. only coarse aggregate omitted); well mixed with water to produce a thick consistency.

G. High Strength Grout: See section 05 1200 or 05 1100 for requirements.

H. Dry Pack: Dry pack (used only for cosmetic concrete repairs) shall consist of:

1. One part cement to 2-1/2 parts fine aggregate (screen out all materials retained on No.4 sieve), mixed with a minimum amount of water, added in small amounts.
2. Mix to consistency such that a ball of the mixture compressed in the hand will retain its shape, showing finger marks, but without showing any surface water.

2.4 ACCESSORIES

A. Bonding Agent: ASTM C881, Type II Grade 2 Class B or C. Do not allow epoxy to set before placing fresh concrete.

1. “MasterEmaco ADH 326” by Master Builders Solutions;
2. “Rezi-Weld 1000” by W.R. Meadows.

B. Chemical Hardener: Fluorosilicate solution designed for densification of cured concrete slabs. “MasterKure HD 300 WB” by Master Builders Solutions, "LIQUI-HARD" W.R. Meadows Co, or equal.

C. Moisture-Retaining Cover: ASTM C171, type 1, one of the following;

1. Regular Curing Paper, Type I, reinforced waterproof: Fortifiber Corporation "Orange Label Sisalkraft", "Pabcotite" paper, or equal.
2. Polyethylene Film: ASTM D 2103, 4 mil thick, clear or white color.
3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd.

D. Liquid Curing Compound: ASTM C 309, Type 1, Class B, clear or translucent, 25% minimum solids, water base acrylic cure/sealer which will not discolor concrete and compatible with bonding of finishes specified in related sections. W.R. Meadows Co. “Vocomp 25” or equal. Maximum VOC content shall comply with local requirements and California Green Building Code.

E. Under Slab Water Vapor Retarder: Vapor retarder sheet to be ASTM E1745 Class A; 15 mil, single ply extruded polyolefin; permeance no greater than 0.01 U.S. Perms per ASTM E154, ASTM E96 procedure B or ASTM F1249.

1. “Stego Wrap Vapor Barrier (15mil)” by Stego Industries LLC.
2. “Vaporguard” by Reef Industries.
3. Approved Equal.

F. Evaporation Reducer: "MasterKure ER 50” by Master Builders Solutions.

G. Permeability Reducer: Use only where specifically referred to.

1. ASTM C494 Type S.
2. Admixture Type: Xypex Chemical Corporation "XYPEX Admix C-500" or Master Builders Solutions “MasterLife 300” series. Dosage: per manufacturer.
3. Surface-Applied Type: Xypex Chemical Corporation "XYPEX Concentrate. Brush application: 1.25-1.50lb/sq. yd., 5 parts powder to 2 parts water. Master Builders Solutions “MasterSeal 500”. Slurry coat: one part water to 2.25-2.5 parts powder by volume.
4. Approved equal.

2.5 JOINT DEVICES AND MATERIALS

A. Waterstops: Resilient type, meeting Corps of Engineers CRD-C 572. Consult manufacturer for appropriate product for specific use. Submit for review. Install per manufacturers recommendation. Provide W. R. Meadows “Seal Tight” PVC waterstop, Sika “Greenstreak” PVC waterstop, or approved equal.

B. Expansion Joint Filler: ASTM D1751, Nonextruding, resilient asphalt impregnated fiberboard or felt, 3/8 inch thick and 4 inches deep; tongue and groove profile.

1. Products: "Serviced Products", W.R. Meadows, Inc., "National Expansion Joint Company", "Celotex Corporation", or equal.

C. Joint Filler: ASTM D944, Compressible asphalt mastic with felt facers, 1/4 inch thick and 4 inches deep.

D. Sealant and Primer: As specified in Section 07 9000.

E. Slab Joint Sealant: Compatible with floor finishes specified in related sections.

2.6 CONCRETE MIXES

A. General requirements for mix design and submittal of structural class concrete:

1. Provide Contractor submittals to Architect/Engineer not less than 15 days before placing concrete.
2. Contractor shall review mix designs and proposed placing requirements prior to submittal for compatibility to ensure that the concrete as designed can be placed in accordance with the drawings and specifications.
3. Changes or revisions require re-submittal: All variations to approved mix designs, including changing type and/or quantity of admixtures shall be resubmitted to the Architect/Engineer for review prior to use.
4. Mix design(s) for all structural classes of concrete to be prepared by qualified person experienced in mix design. Allow for time necessary to do trial batch testing when required.
5. Preparer to provide backup data and certify in writing that mix design meets:
   a. Requirements of the specifications for concrete durability and quality;

b. Requirements of the California Building Code and ACI CODE-318, including break histories, trial batching test results, and/or a mix designed by a California Registered Civil Engineer per ACI CODE-318 and bearing the Engineer's seal & signature.

6. Clearly note on mix designs with specified maximum W/CM if design permits addition of water on site, or clearly identify in the mix design that no water is to be added on site.
7. Deviations: Clearly indicate proposed deviations, and provide written explanation explaining how the deviating mix design(s) will provide equivalent or better concrete product(s) than those specified.
8. Include adjustments to reviewed mix designs to account for weather conditions and similar factors.

B. Proportioning - General: The following provisions apply to all mix designs:

1. Proportion concrete mixes to produce concrete of required average strength (as defined by ACI CODE-318). Select slump, aggregate sizes, shrinkage, and consistency that will allow thorough compaction without excessive puddling, spading, or vibration, and without permitting the materials to segregate, or allow free water to collect on the surface.
2. Select aggregate size and type to produce dense, uniform concrete with low to moderate shrinkage, free from rock pockets, honeycomb and other irregularities.
3. Mix designs may include water reducing and retarding admixtures to meet or exceed minimum set times (time required to place and finish) and to minimize Water-Cementitious Materials Ratios (W/CM). Minimum and maximum criteria presented in this section are guidelines and do not represent a specific mix design.
4. Cement Content: Minimum cement content indicates minimum sacks of cementitious material. Increasing cement content to increase early strengths or to achieve specified W/CM while maintaining water content is discouraged in order to minimize effects of shrinkage.
   a. Substitution of fly ash for Portland cement on an equivalent weight basis up to 25% replacement is permitted, except at high early strength concrete. Replacement in excess of 25% is not permitted unless part of a specified mix design that has been submitted for review.
   b. Substitution of slag cement for Portland cement on an equivalent weight basis up to 45% replacement is permitted, except at high early strength concrete. Replacement in excess of 45% is not permitted unless part of a specified mix design that has been submitted for review.
   c. Such substitution requests may be denied by the Engineer.
5. Water Content: Mix designs with a specified maximum W/CM may be designed with a lower W/CM than specified in order to allow addition of water at the site.
6. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301 and this section.
   a. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.

b. Per DSA IR19-3, trial batching or historic breaks shall be used where fly ash substitution for cement is greater than 15%.

7. Placement Options: Mix designs may, at the Contractor's option, be designed for either pump or conventional placement with aggregate size, slumps, etc. to be maintained as specified in this section.

C. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations and this section.

D. Special mix design requirements for interior concrete floor slabs on ground:

1. Proportion concrete mixes per this specification, ACI PRC-211.1, and the requirements below:
2. Fly Ash shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 25% and a maximum of 35%. Alternatively, Slag Cement, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 30% and a maximum of 45%.
3. 200 lbs. of 3/8(-) aggregate shall be added to reduce total sand.
4. Reduce total sand to minimum practical.
5. Admixture dosage shall be per manufacturer’s recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.

E. Special mix design requirements for high volume fly ash concrete:

1. Proportion concrete mixes per this specification, ACI PRC-211.1, and the requirements below:
2. Fly Ash shall be substituted for cement on a 1 lb. per 1 lb. basis, with a replacement of 50%.
3. Minimum strength at 28 days to be 3000 psi
4. Add 200-300 pounds 3/8” aggregate to replace portion of fine aggregate.
5. Admixture dosage shall be per manufacturer’s recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.
6. Concrete shall be wet cured per CONCRETE CURING.

F. Mix Design Minimum Requirements:

Concrete Class	Coarse Aggregate Size (Inches) & Fine Aggregate[3]	Maximum W/CM or Maximum Nominal Slump & Tolerance (Inches)[1,2]	Minimum 28-Day Design Strength	Minimum Cement Sacks/per yd[4]
NON-STRUCTURAL				
1) Lean Concrete Soil Fill	---	---	1,500	3.0
STRUCTURAL				
2) Interior Slab on Ground[5]	1" x #4	W/CM = .45	3,000	6.1
3) Foundation (including stem walls)	1" x #4	W/CM = .53	3,000	5.0

1. The tolerance is the maximum deviation allowable without rejection. The mix design shall be based on the nominal value specified and is without water reducing mixtures. Slump to be measured at the end of the hose.
2. The maximum W/CM is limited at time of placement as noted. No water is to be added on site such that the specified W/CM or maximum slump is exceeded without approval of the testing laboratory and the Architect/Engineer. Workability is to be achieved utilizing an acceptable mid-range to high range water reducing admixture.
3. Gradation of aggregate is per ACI CODE-318 and ASTM C33.
4. Minimum cement content includes all cementitious materials.
5. See Article 2.6E for additional requirements at slabs on ground.
6. See article 2.6F for additional requirements at high volume fly ash concrete.

2.7 MIXING CONCRETE

A. Batch final proportions in accordance with approved mix designs. All adjustments to approved proportions, for whatever reason, shall be reviewed by the Architect/Engineer prior to use.

B. Batch and mix concrete in accordance with ASTM C94, at an established plant. Site mixed concrete will be rejected.

C. Provide batch and transit equipment adequate for the work. Operate as necessary to provide concrete complying with specified requirements.

D. Place mixed concrete in forms within 1-1/2 hours from the time of introduction of cement and water into mixer or 300 revolutions of the drum whichever comes first. Use of, re-mixing, and/or tempering mixed concrete older than 1 hour will not be permitted.

E. Do not add water at the site to concrete mixes with a maximum specified W/CM unless the water content at batch time provides for a W/CM less than specified and this provision, including the quantity of water which may be added at the site, is specifically noted on the mix design and certification by the mix preparer. See ASTM C94 for additional requirements.

2.8 SOURCE QUALITY CONTROL

A. Services by independent Testing Agency:

1. Where aggregate alkali reactivity testing (and, when applicable, mitigation testing) per the MATERIALS section is not available, the Testing Agency shall perform this testing to verify materials conformance to CBC section 1903A.5.
2. Batch Plant inspection at automated plants to occur at commencement of concrete work each day (first truck). Batch Plant inspection at non-automated plants and when accuracy is questionable shall be continuous. Additionally, water cement ratio (WCR) is to be verified where a WCR is specified herein. The computed WCR is to be written on the Batch Plant Certificate to be taken to the job site prior to the truck leaving the plant. See requirements of CBC 1705A.3.3.
3. Batch Plant Certificates: Obtain the weighmaster's Batch Plant Certificate at arrival of truck at the site. If no batch plant certificate is provided, recommend to the General Contractor that the truckload of concrete be rejected. So note in daily log, along with the location of the load of concrete in the structure if the load is not rejected. See requirements of CBC 1705A.3.3.
   a. Laboratory's inspector shall obtain for each transit mixer Batch Plant Certificates to verify mix design quantities and condition upon delivery to the site.
   b. Certificates to include: Date, time, ingredient quantities, water added at plant and on job, total mixer revolutions at time of placement, and time of departure.
   c. Concrete with specified water cement ratio: Add no water on site unless mix design and batch records each show additional water may be added. See ASTM C94 for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify work of other sections is complete and tested as required before proceeding.

3.2 PREPARATION

A. Observation, Inspection and Testing:

1. Architect/Engineer: Notify not less than 2 working days before each concrete placement, for observation and review of reinforcing, forms, and other work prior to placement of concrete.
2. Testing Agency: Notify not less than 24 hours before each placement for inspection and testing.

B. Placement Records: Contractor shall maintain records of time, temperature and date of concrete placement including mix design and location in the structure.

C. Retain records until completion of the contract. Make available for review by Testing Agency and Architect/Engineer.

D. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

E. Verify location, position and inclusion of all embedded and concealed items.

F. Verify installation of vapor retarder under interior slabs on ground, as specified in related section, is complete.

G. Cleaning and Preparation:

1. Remove loose dirt, mud, standing water, and foreign matter from excavations and cavities.
2. Close cleanout and inspection ports securely.
3. Thoroughly clean reinforcement and other embedded items free from loose rust and foreign matter. Maintain reinforcing securely in place. Do not place concrete on hot reinforcing.
4. Dampen form materials and substrates on which concrete is to be placed at least 1 hour in advance of placing concrete; repeat wetting as necessary to keep surfaces damp. Do not saturate. Do not place concrete on saturated material.
   a. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, adjacent concrete or masonry and reinforcement.
   b. Concrete slabs on base rock, dampen rock.
   c. Concrete slabs on vapor retarder, do not wet vapor retarder.
5. Verify that metal forms are clean and free of rust before applying release agent.
6. Thoroughly clean metal decking. Do not place concrete on wet deck surface.
7. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

H. Drill holes in existing concrete at locations where new concrete is doweled to existing work. Insert steel dowels and prepare connections as detailed.

I. Do not overcut at existing concrete work to remain. Contractor is responsible for repair/replacement of overcut concrete to the Owner’s satisfaction.

3.3 PIPES AND CONDUITS IN CONCRETE

A. Slabs-on-Ground:

1. No pipe or conduit exceeding 1 inch outside diameter shall be embedded within the specified slab thickness except as specifically detailed.
2. Do not stack or abut pipes, maintain 3 inches minimum clearance.

B. Sleeving and Wrapping:

1. Foundations: Sleeve or wrap all individual pipe penetrations, minimum 1-1/2 inches clear to reinforcing all around.

a. Sleeves: PVC. Provide 1 inch minimum clear all around O.D. pipe to I.D sleeve, UNO at ends, fill void space with mastic or plastic bituminous cement.
b. Wrapped Vertical Pipes: Provide 1/8 inch nominal sheet foam with three wraps minimum, UNO.
c. Wrapped Horizontal Pipes: Provide 1/8 inch nominal sheet foam with eight wraps minimum, UNO.
d. Underground Fire Lines 4" and Larger: At sleeves provide 2 inch minimum clear all around O.D. pipe to I.D sleeve. At wrapped pipes, provide 1/8 inch nominal sheet foam with sixteen wraps minimum.

2. Slabs or Curbs: Wrap pipes as described above.

C. Space groups of pipes/conduits at least 3 sleeve diameters apart, do not interrupt specified concrete and reinforcement.

1. Provide block-outs as detailed when grouping of pipes/conduits in foundation or other structural member prevents spacing as described. Notify Architect/Engineer for review of any conditions not conforming to details.
2. Center pipe/conduit penetrations in the depth and/or thickness of foundations.
3. Maximum size of pipe/conduit penetrations shall not exceed the least dimension of concrete divided by 3.

D. Provide the following at pipes/conduits detailed to be embedded in a concrete wall:

1. Place as near as possible to center of member with reinforcing as specified on each side.
2. Where reinforcing is located near or at center of member, place pipe or conduit 1 inch minimum clear from reinforcing and provide #3 at 12 inches on center perpendicular to the pipe/conduit. Reinforcing to extend 12 inches minimum past pipe/conduit each side.
3. Maintain ¾ inch clear minimum from added reinforcing to face of concrete where not exposed to weather and 1-1/2 inches clear where exposed to weather.
4. Space embedded items (groups of pipe/conduit, junction boxes or other elements) minimum 3 inches apart.
5. Provide reinforcing in walls as detailed for groups of pipe/conduit. Provide minimum replacement reinforcement of same size and number for interrupted or displaced reinforcement for the full height, length, width of the wall on each side of the "effective opening."

3.4 CONCRETE PLACEMENT

A. Transporting:

1. Provide clean, well-maintained equipment of sufficient quantity and capacity to execute the work and produce concrete of quality specified.
2. Handle and transport concrete from mixer to final deposit location as rapidly as practicable. Prevent separation or loss of ingredients.

B. Perform concrete placement by methods which will not puncture, damage or disturb vapor retarder membrane. Repair all damage to vapor retarder membrane before covering.

C. Placement - General: Placement, once started, shall be carried on as a continuous operation until section of approved size and shape is completed. Provide construction joints as detailed on the drawings. Engineer's written approval required for all deviations.

1. Deposition:
   a. Deposit concrete to maintain an approximately horizontal plastic surface until the completion of the unit placement.
   b. Deposit as neatly as practicable in final position, minimize re-handling or flow.
   c. Do not drop concrete freely where reinforcing bars, embeds, or obstructions occur that may cause segregation. Provide spouts, elephant trunks, or other means to prevent segregation during placement.
2. Depth: Layered placement in columns and walls shall not exceed ten feet vertical depth.
   a. Place concrete in minimum 32 inch horizontal lifts.
   b. Schedule placement to ensure that concrete will not take initial set before placement of next lift.
   c. No horizontal cold joints are allowed in columns or walls.
3. Progress Cleaning: Remove all concrete spilled on forms or reinforcing steel in portions of structure not immediately concreted. Remove completely before concrete sets.
4. Interruptions: Shut down placement operations and dispose of all remaining mixed concrete and concrete in hoppers or mixers following all interruption in placement longer than 60 minutes.
   a. If such interruption occurs, provide new or relocate existing construction joints as directed by Engineer.
   b. Cut concrete back to the designated line, cleaning forms and reinforcing as herein specified.
   c. Prepare for resumption of placement as for new unit when reason for interruption is resolved.

D. Consolidation:

1. Consolidate all concrete thoroughly during placement with high-speed mechanical vibrators and other suitable tools. Perform manual spading and tamping to work around reinforcement, embedded fixtures, and into corners of formwork as required to obtain thorough compaction.
   a. Provide vibrators with sufficient amplitude for adequate consolidation.
   b. Use mechanical vibrators at each point of concrete placement.
   c. Keep additional spare vibrators, in addition to those required for use, at the site for standby service in case of equipment failure.
2. Consolidate each layer of concrete as placed.
   a. Insert vibrators vertically at points 18 to 30 inches apart; work into top area of previously placed layer to reconsolidate, slowly withdraw vibrator to surface.
   b. Avoid contact of vibrator heads with formwork surfaces.

c. Systematically double back and reconsolidate wherever possible. Consolidate as required to provide concrete of maximum density with minimized honeycomb.

E. Unacceptable Materials:

1. Do not place concrete that has started to set or stiffen. Dispose of these materials.
2. Do not add water on site to concrete except as specified in the approved mix design, see PART 2 above.

F. Protection of installed work:

1. Do not introduce any foreign material into any specified drainage, piping or duct systems.
2. Contractor shall bear all costs of work required to repair or clean affected work as a result of failure to comply with this requirement.

3.5 CONCRETE JOINTS

A. Structural Joints (Construction/Cold Joints):

1. Locate joints only where shown, or as approved.
2. Review Required: Joints not indicated on the plans shall be located to meet the minimum requirements below, shall not impair the strength of the structure and shall be submitted to Architect/Engineer for review prior to placement of concrete.
   a. Indicate proposed location(s) of construction/cold/expansion joints on shop drawing submittals for review prior to placing concrete.
3. Clean and roughen all surfaces of previously placed concrete at construction joints by washing and sandblasting to expose aggregate to 1/4 inch amplitude.
4. Slabs-On-Ground: Maximum Length of continuous placement shall not exceed 60 feet without special review by the Architect/Engineer. Alternate or stagger placement sections.
5. Foundations: Maximum Length of continuous placement shall not exceed 200 foot increments. Provide “keyed” shut-off locations made up with form boards. Extend reinforcing one lap length or more through shut-off.
   a. All reinforcement shall be continuous through construction/cold joint, lapping to adjacent reinforcing in future placement.
6. Horizontal Construction Joints: Place 2 inch slurry (specified concrete mix less coarse aggregate) at beginning of pour at the bottom of walls unless a prior review of a mock-up section demonstrates that segregation of aggregate will not occur.

B. Expansion/Construction Joints (Dowel Joints and Control Joints):

1. Interior and Exterior Slabs-on-Ground:
   a. Expansion/Construction Joints: Provide dowel joints or control joints at a maximum dimension (in feet) of three times the slab thickness (in inches) in each direction unless noted otherwise (15’-0” maximum). Install joints to match slab level and in straight lines. Locate joints at all reentrant corners including blockouts.

b. Proportions: Install joints to divide slab into rectangular areas with long dimensions less than 1.5 times short dimension.

2. Exterior Concrete Slabs on Ground (walkways, patios):
   a. Expansion/ construction joints: Provide a 2 inch deep troweled groove or asphalt impregnated joint material embedded 50 percent of the slab depth at 12 feet on center, maximum.
   b. Proportions: Place no section with a length larger than two times width. Additionally, place joints at all inside corners and at all intersections with other work.

C. Joint Types:

1. Dowel Joint: A keyed joint with smooth dowels passing through to allow unrestricted movement due to contraction and expansion. Joints are as specified on the drawings.
2. Control Joint(s): Shrinkage crack control joints may be of the following types when shown on the drawings. Install joints in a straight line between end points with edges finished appropriate to type. Depth shall be 25% of the slab thickness, unless noted otherwise. Fill joints with sealant as shown on the drawings or as required by related sections.
   a. 1/4 inch wide troweled joint.
   b. Keyed joint: Only at locations where concealed by other finishes.
   c. Masonite Strip, 1/8 inch: Only at locations where concealed by other finishes.
   d. Saw Cut, 1/8 inch: Must be performed within eight hours of completion of finishing. Do not make saw cuts if aggregate separates from cement paste during cutting operation. Prevent marring of surface finish. Fill with flexible sealant.

3.6 VAPOR RETARDER

A. Vapor Retarder Installation: Install as specified in PART 2, ASTM E1643, and per manufacturer's recommendations including taping and lapping of seams, sealing of penetrations, and repair of damage. Do not extend vapor retarder below footings.

3.7 FLATWORK

A. General Requirements for All Concrete Formed & Finished Flat:

1. Edge Forms and Screeds: Set accurately to produce indicated design elevations and contours in the finished surface, edge forms sufficiently strong to support screed type proposed.
2. Jointing: Located and detailed as indicated.
3. Consolidation: Concrete in slabs shall be thoroughly consolidated.

B. Flatwork Schedule:

1. Exterior Slabs-On-Ground: Place concrete directly over sub-base as indicated.
   a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
2. Interior Slabs-On-Ground:

a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
b. Vapor Retarder: Install over sub-base.

3.8 FORMED SURFACES

A. Form all concrete members level and plumb, except as specifically indicated. Comply with tolerances specified in ACI CODE-318, ACI SPEC-301, and this specification, except that maximum permissible deviation is 1/4 inch end-to-end for any single member.

3.9 CONCRETE FINISHES

A. Flatwork Finishing:

1. All exposed concrete flatwork surfaces shall be non-slip. See Architectural, Civil, and Landscape drawings.
2. Perform with experienced operators.
3. Finish surfaces monolithically. Establish uniform slopes or level grades as indicated. Maintain full design thickness.
4. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on drawings.
5. Flatwork Finish Types:
   a. Wood Float Finish: Surfaces to receive quarry tile, ceramic tile, or cementitious terrazzo with full bed setting system, or wood frame for raised finished floors.
   b. Steel Trowel Finish: Surfaces to receive carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set tile or similar finishes specified in related sections. Trowel twice, minimum.
   c. Broom Texture Finish: Exterior surfaces as indicated or for which no other finish is indicated. Finish as for steel trowel finish, except immediately following first troweling, (depending on conditions of concrete and nature of finish required) provide uniform surfaces texture using a medium or coarse fiber broom.

B. Other Concrete: Provide as required to achieve appearance indicated on structural and architectural drawings and related sections.

1. Repair surface defects, including tie holes, immediately after removing formwork.
2. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
3. Exposed Form Finish: Finish concrete to match forms. Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   a. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
   b. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

c. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

4. Intermediate joint and score marks and edges: Tool smooth and flush unless otherwise indicated or as directed by the Architect.
5. Use steel tools of standard patterns and as required to achieve details shown or specified. All exposed corners not specified to be chamfered shall have radiused edges.

3.10 TOLERANCES

A. Minimum Flatwork Tolerances: Measure flatness of slabs with in 48 hours after slab installation in accordance with ACI PRC-302.1 and ASTM E1155 and to achieve the following FF and FL tolerances:

1. Exterior surfaces: 1/8 inch minimum per foot where sloped to drain. Level otherwise. FF20 and FL15.
2. Interior surfaces not otherwise shown or required: Level throughout. FF25 and FL20
3. Interior surfaces required to be sloped for drainage: 1/8 inch in 10 ft.
4. Finish concrete to achieve the following tolerances:
   a. Under Glazed Tile on Setting Bed: FF30 and FL20.
   b. Under Resilient Finishes: FF35 and FL25.
   c. Flooring manufactureer and pertainent section of Division 9.

B. Formed Surface Tolerances:

1. Permanently Exposed Joints and Surfaces: Provide maximum differential height within two feet of, and across construction joints of 1/16 inch.
2. Vertical Elevations: Elevation of surfaces shall be as shown or approved.

3.11 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels not to exceed 20 feet in either direction.

F. Screed toppings level, maintaining surface tolerances per above.

3.12 CONCRETE CURING

A. Curing - General: Cure in accordance with ACI SPEC-308.1. Maintain concrete water content for proper hydration and minimize temperature variations. Begin curing immediately following finishing.

B. Protection During Curing: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. The General Contractor is responsible for the protection of the finished slab from damage.

1. Avoid foot traffic on concrete for minimum of 24-hours after placement.
2. Protect concrete from sun and rain.
3. Maintain concrete temperature at or above 50 degrees F. during the first 7 days after placement. See Article ENVIRONMENTAL REQUIREMENTS.
4. Do not subject concrete to design loads until concrete is completely cured, and until concrete has attained its full specified 28-day compressive strength or until 21 days after placement, whichever is longer.
5. Protect concrete during and after curing from damage during subsequent building construction operations. See Article PROTECTION.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than 7 days.
2. High early strength concrete: Not less than 4 days.

D. Begin curing immediately following finishing.

E. Surfaces Not in Contact with Forms:

1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than 3 days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Begin final curing after initial curing but before surface is dry.
   a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
   b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.
3. In addition, see specific conditions noted below.

F. Slabs on Ground: Cure by one of the following methods:

1. Water Cure (Ponding): Maintain 100 percent coverage of water over floor slab areas, continuously for minimum 7 calendar days.
2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
3. Moisture-Retaining Film or Paper: Lap strips not less than 6 inches and seal with waterproof tape or adhesive; extend beyond slab or paving perimeters minimum 6 inches and secure at edges; maintain in place for minimum 7 days.

4. Absorptive Moisture-Retaining Covering: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides and extend beyond slab or paving perimeters 6 inches minimum; maintain in place for minimum 7 days.
5. Liquid Membrane-forming Curing Compound: Provide only when subsequent concrete treatments or finish flooring specified in related sections will not be affected by cure/sealer. Apply curing compound in accordance with manufacturer's instructions at the maximum recommended application rate in two coats, with second coat applied at right angles to first.

G. Formed Concrete Members: Cure by moist curing with forms in place for full curing period.

1. Protect free-standing elements from temperature extremes.
2. Maintain forms tight for minimum 7 days. Maintain exposed surfaces continuously damp and completely covered by sheet materials thereafter.
3. Maintain all shoring in place. Refer to related sections specifying formwork.
4. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

H. Foundations: Apply curing compound immediately after floating.

3.13 CONCRETE HARDENER

A. Apply hardener to all floor slabs not receiving other finishes after 30 days minimum curing. Clean slabs of non-compatible cure/sealers or other foreign material(s) and apply in strict accordance with the manufacturer's directions.

3.14 GROUTING AND DRY PACK

A. Set steel plates on concrete or masonry with high strength grout bed, completely fill all voids; thoroughly compact in place. See Section 05 1200 or 05 1100.

B. Bolts or inserts dry packed or grouted in place shall cure for minimum 7 days before tensioning.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspections by Independent Testing Agency: Provided verification and inspection of concrete per CBC Table 1705A.3. Provide written reports for to Engineer, Architect, Contractor and Building Official for the following tests and inspections:

B. Testing & Inspection: Provide periodic inspection of reinforcing steel. Provide continuous inspection during placement of structural class concrete, 3000 psi or more. Non-structural class concrete with a design strength of 2500 psi or less to have periodic inspection on a 150 cubic yard basis as required to assure conformance.

1. Provide periodic inspection of bolts in concrete prior to and during placement where so noted on the construction documents.

2. Structural Concrete Cylinder Tests: Form in accordance with ASTM C31.
   a. Take four standard 6 inch x 12 inch (or five 4 inch x 8 inch) cylinder specimens on the site, of each class of concrete as specified in PART 2, not less than once a day or for each 50 cubic yards or 2000 sq ft or fraction thereof placed each day.
   b. Record the location of each concrete batch in the building in a log and also note on each specimen.
   c. Perform standard compression test of cylinders in accordance with ASTM C39, one at 7 days and two (three for 4x8 cylinders) at 28 days.
   d. Hold fourth (fifth) cylinder untested until specified concrete strengths are attained.
3. Structural Concrete Slump Test and Air Tests: Perform slump in accordance with ASTM C143 and air content in accordance with C231 or C173 at the time of taking test cylinders, and/or at one-hour intervals during concrete placing.
4. Measure and record concrete temperature in accordance with ASTM C1064 upon arrival of transit mixers and when taking specimens. Note weather conditions and temperature.
5. Determine concrete density in accordance with ASTM C138 at the time of forming test cylinders.
6. Propose adjustments to reviewed mix designs for Architect / Engineer review to account for variations in site or weather conditions, or other factors as appropriate.
7. Water Vapor Transmission Tests: Floors receiving floor finishes specified in related sections will be tested prior to installation of flooring systems. Refer to sections specifying floor finishes for related requirements.

C. Services by Contractor:

1. Rejection of Concrete Materials: Do not use the following without prior written approval of the Architect/Engineer;
   a. Materials without batch plant certificates.
   b. Materials not conforming to the requirements of these specifications.

3.16 ADJUSTING

A. Inspect all concrete surfaces immediately upon formwork removal. Notify Architect/Engineer of identified minor defects. Repair all minor defects as directed.

B. Surface and Finish Defects: Repair as directed by the Architect/Engineer, at no added expense to the Owner. Repairs include all necessary materials; reinforcement grouts, dry pack, admixtures, epoxy and aggregates to perform required repair.

1. Repair minor defective surface defects by use of drypack and surface grinding. Specific written approval of Architect/Engineer is required. Submit proposed patching mixture and methods for approval prior to commencing work.

2. Slabs-on-Ground: Review for "curled" slab edges and shrinkage cracks prior to installation of other floor finishes. Grind curled edges flush, fill cracks of 1/16 inch and greater with cementitious grout.
3. Grind high spots, fins or protrusions caused by formwork; Fill-in pour joints, voids, rock pockets, tie holes and other void not impairing structural strength. Provide surfaces flush with surrounding concrete.

3.17 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required compressive strength, lines, details, dimensions, tolerances, finishes or specified requirements; as determined by the Architect/Engineer.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer who may order additional testing and inspection at his option. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Specific Defects:

1. "Low-Strength"; Concrete Not Meeting Specified Compressive Strength after 28 days:
   a. Concrete with less than 25% Fly Ash or 35% Slag as cementitious material: Test remaining cylinder(s) at 56 days. If strength requirements are met, concrete strength is acceptable.
   b. Concrete with 25% or more Fly Ash or 35% or more Slag as cementitious material: Test remaining cylinder(s) at 70 days. If strength requirements are met, concrete strength is acceptable.
2. Excessive Shrinkage, Cracking, Crazing or Curling; Defective Finish: Remove and replace if repair to acceptable condition is not feasible.
3. Lines, Details, Dimensions, Tolerances: Remove and replace if repair to acceptable condition is not feasible.
4. Slab sections not meeting specified tolerances for trueness/flatness or lines/levels: Remove and replace unless otherwise directed by the Architect/Engineer. Minimum area for removal: Fifteen square feet area unless directed otherwise by the Architect/Engineer.
5. Defective work affecting the strength of the structure or the appearance: Complete removal and replacement of defective concrete, as directed by the Architect/Engineer.

3.18 CLEANING

A. Maintain site free of debris and rubbish. Remove all materials and apparatus from the premises and streets at completion of work. Remove all drippings; leave the entire work clean and free of debris.

B. Slabs to Receive Floor Finishes Specified in other sections: Remove non-compatible cure/sealers or other foreign material(s) which may affect bonding of subsequent finishes. Leave in condition to receive work of related sections.

3.19 PROTECTION

A. Protect completed work from damage until project is complete and accepted by Owner.

B. Construction Loads: Submit engineering analysis for equipment loads (including all carried loads) specified in article submittals.

C. Keep finished areas free from all equipment traffic for a minimum of 4 additional days following attainment of design strength and completion of curing.

D. Protection of Drainage Systems:

1. Care shall be taken not to introduce any foreign material into any specified drainage, piping or duct system.
2. Cost of work to repair or clean drainage system as a result of failure to comply with this requirement will be back charged to the contractor.

E. Cover traffic areas with plywood sheets or other protective devices; maintain protection in place and in good repair for as long as necessary to protect against damage by subsequent construction operations.

END OF SECTION

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SECTION 03 35 15

SEALED CONCRETE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide applied curing, hardener, sealer type curing compound to concrete flooring including preparation of concrete as required for complete installation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene not less than one week prior to commencing applying hardener sealer at areas indicated to have a hardener sealed finish.

1. Require attendance of those directly affecting work of this Section.

2. Review concrete installation and coordinate required preparation.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of material involved in curing, hardener, sealer for concrete.

B. Samples: Furnish sample panels of concrete with curing, hardener, sealer applied to half of surface; indicate which half has hardener sealer.

C. Maintenance Instructions: Provide written instructions for recommended periodic maintenance.

1.4 QUALITY ASSURANCE

A. Curing, Hardener, Sealer Installers: Firms with not less than five years successful experience applying specified curing, hardener, sealer and acceptable to system manufacturer.

B. Mock-Up: Erect minimum 100 square feet of concrete flooring with curing, hardener, sealer at location as approved. Approved mock-up may be incorporated into Project.

PART 2 - PRODUCTS

2.1 SYSTEM MANUFACTURERS

A. W.R. Meadows, Inc. (800.342.5976).

B. Nox-Crete Products Group (800.669.2738).

C. PROSOCO, Inc. (800.255.4255).

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide applied curing, hardener, sealer to concrete flooring.

B. Regulatory Requirements, VOC Emissions: Comply with applicable limitations for volatile organic compound (VOC) emissions for concrete sealing materials.

C. Accessibility Regulatory Requirements: Provide for assuring access for persons with disabilities in accordance with state and federal regulations for slip resistance.

1. California Regulations: Comply with California Building Standards Code.

2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.

3. Slip-Resistant Hard Surfaces: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and requirements for access for persons with disabilities.

D. Hardener, Sealer, Densifier: Provide water borne penetrating lithium silicate system designated by system manufacturer as hardener, sealer, densifier.

1. Basis of Design: W. R. Meadows, Inc./Liqui-Hard Ultra.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure surfaces to receive hardener sealer are clean and well cured.

B. Do not commence work until surface conditions are within tolerances required for proper finishing based on manufacturer recommendations.

C. Start of work indicates acceptance of conditions.

3.2 PREPARATION

A. Clean concrete slab free from foreign matter and prepare concrete for sealing in accordance with system manufacturer recommendations.

3.3 INSTALLATION

A. Comply with curing, hardener, sealer manufacturer recommendations and application instructions for application of concrete hardener sealer densifier as required to match approved samples and mock-up.

3.4 PROTECTION

A. Comply with system manufacturer recommendations for protecting floors until ready for use. Keep surface dry for minimum 48 hours after application.

B. Do not permit traffic on floors with curing, hardener, sealer for at least 72 hours.

C. Protect floors with curing, hardener, sealer until Substantial Completion.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials, equipment and operations required to complete structural and miscellaneous metals in shapes and configurations indicated; including:

1. Structural steel columns, beams, bracing, base plates, bolts, joist hangers, and stud bolts welded to structural steel.
2. Miscellaneous structural steel and connections; fabricated connectors and hangers installed by related sections.
3. Anchor bolts and steel inserts embedded in concrete or masonry, installed by related sections.
4. Fabricated steel items embedded in concrete or masonry installed by related sections.
5. Supervision of anchor bolt setting, leveling and elevations to ensure required fit of steel work.
6. Shop priming and field touch-up, galvanizing.
7. Bracing, Shoring, Fabrication and Erection.

B. Related Sections:

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
2. Pertinent Sections of other Divisions specifying concrete reinforcement, formwork, concrete, structural and miscellaneous metal fabrications, steel joists, metal decking, cold-formed metal framing, rough carpentry.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22A Steel.

B. American Institute of Steel Construction (AISC) 303 “Code of Standard Practice for Steel Buildings and Bridges”.

C. AISC 341 “Seismic Provisions for Structural Steel Buildings”.

D. AISC 358 “Prequalified Connection for Special and Intermediate Steel Moment Frames for Seismic Applications”.

E. AISC 360 “Specification for Structural Steel Buildings”.

F. American Welding Society (AWS) D1.1 “Structural Welding Code - Steel”.

G. AWS D1.8 “Structural Welding Code - Seismic Supplement”.

H. Research Council on Structural Connections (RCSC) “Specification for Structural Joints Using High-Strength Bolts”.

I. Underwriters Laboratories (UL) FRD “Fire Resistance Directory”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

D. Shop drawings: Submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;

1. Profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Fabrication tolerances for all steel.
3. Connections: All, including type and location of shop and field connections.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, type, size, and sequence. Designate demand critical welds.
5. Designation of Seismic Force Resisting System (SFRS) members and connections. Locate and dimension protected zones. Braced frame gusset plates shall be drawn to scale.
6. Cross-reference all shop drawing detail references to contract document detail references.
7. Secure all field measurements as necessary to complete this work prior to submitting shop drawings for review.
8. Provide holes, welded studs, etc. as necessary to secure work of other sections.
9. Provide the following as separate submittals for each building or unit of work:
    a. Bolt and anchor setting plans.
    b. Layout, fabrication and erection drawings.

E. Certifications:

1. Steel Materials: Submit the following for identified materials.
    a. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

b. Mill Test Reports: Indicate structural strength, destructive test analysis, and non-destructive test analysis.
c. Contractor's affidavit certifying that all identified steel materials provided are of the grades specified and match the certificates supplied.

2. High-Strength Bolting: Certify all materials provided are the grades specified.
3. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification per AWS D1.1.

F. Samples: Provide samples to the Testing Agency as specified in Article SOURCE QUALITY CONTROL, at no additional costs.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17A.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of steel. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.

1. Test all steel as required by ASTM A6.
2. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
3. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each material type and/or heat number in the project (i.e. walls, braced frames etc.).
4. Unidentified Material Tests: Where identification of materials by heat number or mill tests cannot be made, Owner's Testing Agency shall test unidentified materials.
5. Provide all certification, verifications, and other test data required to substantiate specified material properties at no additional cost to the Owner.

D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent sections of Division 01.

E. The following standards are the minimum level of quality required. Provide higher quality work as specifically indicated in the Contract Documents.

1. Workmanship and details of structural steel work shall conform to the CBC and AISC 360.

2. The quality of materials and the fabrication of all welded connections shall conform to AWS D1.1 and D1.8.
3. Comply with Section 10 of AISC 303 for architecturally exposed structural steel.

F. The Testing Agency will review all submittals and testing of materials.

G. All re-inspections made necessary by non-conforming work shall be at the Contractor's expense.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in bundles marked with durable tags indicating heat number, mill, member size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

B. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

1.6 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel W Shapes: ASTM A992 Gr. 50 or ASTM A572 Gr. 50.

B. Structural Steel Plates: ASTM A36 or ASTM A572 Gr. 50 or ASTM A529 Gr. 50

C. Structural Steel Channels, Angles: ASTM A36 or ASTM A572 Gr. 50.

D. HSS (Hollow Structural Sections):

1. Round: ASTM A500, Gr. C.
2. Rectangular or Square: ASTM A500, Gr. C.

E. Pipe: ASTM A53, Grade B.

F. Bolts and Washers: See FINISHES section for galvanization, where required.

1. Machine Bolts, Carriage Bolts, Nuts, and Washers: Bearing and shear connections (denoted as “MB” or “CB”); ASTM A307 Grade A machine or carriage bolts with ASTM A563 Grade A nuts and ASTM F844 washers to match.
2. High Strength Bolts, Nuts, and Washers: Bearing and shear connections

(denoted as “HSB”); ASTM F3125 Grade A325 or A490 with ASTM A563 Grade C nuts (Grade DH at A490) and ASTM F436 Type 1 washers.

a. HSB-N: For use in snug tight (ST), pretensioned (PT), and slip critical (SC) joints. Conform to the RCSC Specifications.
b. Use of ASTM F3125 Grade F1852 (twist off assemblies) is permitted conforming to requirements of RCSC Specifications.
c. Use of ASTM F959 Load Indicator Washers is permitted conforming to the requirements of RCSC Specifications.
d. Slip critical (SC) bolt faying surfaces shall be prepared per RCSC as Class A, unless noted to be Class B per the drawings. Galvanized surfaces at SC bolts shall be hand wire brushed.

G. Welded Headed/Threaded Stud Type Shear Connectors: ASTM A108 and AWS D1.1 Section 7. Minimum yield strength is 51,000 pounds per square inch.

H. Deformed Bar Anchors: ASTM A1064.

I. Anchor Bolts/Rods:

1. ASTM F1554 Grade 36 or 55 with ASTM A563 Grade A nuts and ASTM F436 Type 1 washers.
2. No upset thread allowed.

J. Arc-Welding Electrodes: AWS Standards E70 or equivalent, except no E70T-4 allowed. Additionally, welding electrodes to be used in the welding of seismic force resisting system to conform to AISC 341 and AWS D1.8.

K. Other Welding Materials: AWS D1.1; type required for materials being welded.

2.2 ACCESSORIES

A. High Strength Grout: ASTM C1107, non-shrink, premixed compound consisting of aggregate, cement, and water reducing plasticizing agents.

1. Minimum Compressive Strength at 3 days: 3000 psi.
2. Minimum Compressive Strength at 28 days: 7000 psi, placed in a “fluid” state.
3. Provide only non-metallic grout at exposed work.
4. Meet or exceed properties of BASF "Master Flow 928" mixed to fluid consistency. Other acceptable manufacturers: The Burke Company and W.R. Meadows, Inc.

B. Building Structural Steel Primers: Comply with local VOC limitations of authorities having jurisdiction and the California Green Building Code. Verify compatibility with finish coats specified in other sections. Follow manufacturers printed instructions. Apply one coat unless otherwise directed.

1. Type A: Self-Crosslinking Hydrophobic Acrylic passing 2000 hours ASTM D4585 and 7000 hours ASTM D5894. “Series 115 Uni-Bond DF” by Tnemec (2.0 to 4.0 mils DFT).
2. Type B: Organic Zinc-Rich Urethane passing 50,000 hours ASTM B117 and 15000 hours ASTM G85. “Series 90-97 Tneme-Zinc” by Tnemec

(2.5 to 3.5 mils DFT) or “Series 94-H20 Hydro-Zinc” by Tnemec (2.5 to 3.5 mils DFT).

3. Type C: MIO-Zinc Filled Urethane passing 10,000 hours ASTM B117 and 5000 hours ASTM D4585. “Series 394 PerimePrime” by Tnemec (2.5 to 3.5 mils DFT).

C. Galvanizing: ASTM A153 and A123.

D. Touch-Up Primer for Galvanized Surfaces: Type B primer.

2.3 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal built up members by continuous welds where exposed to weather.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Protect all materials, before and after fabrication, from rust, corrosion, dirt, grease, and other foreign matter.

E. Fabricate framing members free from twists or bends. Form holes, cut and sheared edges neatly without kinks, burrs, or warped edges.

F. Exposed Steel: Straight, smooth, free of nicks, scars or dents.

G. Gas Cutting: Gas cutting of holes in a member shall not be permitted.

H. Splicing of members: Members requiring splicing due to length requirements may be spliced using full penetration butt welds when such welds and procedures are inspected and certified by the Testing Agency, in conformance with AWS and AISC standards. The location of splices shall be approved by the Architect/Engineer in writing prior to fabrication.

I. Welding: Welding of structural steel connections shall be performed by qualified welders in accordance with AWS Standards. All weld sizes shall match those shown on the drawings.

1. Preparation: Clean all surfaces free of rust, paint and all foreign matter. Remove paint or scale by brushing, chipping or hammering as required. Chip clean and wire brush burned or flame cut edges before welding. Space and alternate welds, clamping as necessary to prevent warp or misalignment.
2. Sequence Welding: When welds enclose, or partially enclose, the perimeter or portion of the surface of a member, make weld bead in sequence, or staggered. Minimize internal stresses. Weld groups of members occurring in a single line in staggered sequence to minimize distortion of the structural frame.
3. Faulty and Defective Welding: Welds failing to meet AWS standards and the Contract Documents shall be rejected and remade at Contractor expense. All welds showing cracks, slag inclusion, lack of fusion, bad

undercut or other defects, ascertained by visual or other means of inspection shall be removed and replaced with conforming work.

4. Minimum Weld Strengths: All welds shall match the minimum weld sizes recommended by AISC. Details of fabrication not specifically shown shall match similar details which are specifically shown. All bevel and groove welds shall be full penetration unless size is noted otherwise.
5. Threaded studs, headed studs, and deformed bar anchors shall be full-fusion welded conforming to ASW D1.1.

J. Camber: Fabricate all beams cambered as indicated on the drawings.

1. Fabricate beams without camber for installation with any "natural" crown up.
2. Exception: Fabricate cantilever beams with "crown" down.

K. Grinding: Grind smooth the following structural steel and connections;

1. Exposed cut ends of structural and fabricated shapes.
2. All welds exposed to view.
3. Mitered and fit-up corners and intersections.

L. Back-Up Bars: Required for all complete penetration welds. See requirements of AISC 358.

M. Bolt Holes: Edge, end distances and spacing shall conform to dimensions shown on the drawings, and as follows;

1. Round: Size indicated and 1/16 inch maximum oversize, except 1 inch and larger bolts may have 1/8 inch maximum oversize.
2. Slotted: At locations specifically noted on the drawings, provide size indicated and 1/16 inch by 1/4 inch oversize slotted in direction perpendicular to applied loads.
3. Holes in base plates for anchor bolts may be 1/8 inch oversize.

N. Comply with Section 10 of AISC 303 for architecturally exposed structural steel (AESS). See architectural & structural drawings for locations of AESS.

2.4 FINISHES

A. Steel exposed to inclement atmospheric conditions or weather (such as coastal moisture or seasonal rain) shall be sufficiently primed or otherwise protected against corrosion. If condition of steel is suspect due to weathering/corrosion, Contractor shall bear cost of inspection to determine if excessive corrosion is present and if steel member(s) requires repair or replacement. Contractor shall bear cost of repair or replacement.

B. Prepare and finish structural and miscellaneous steel component surfaces as follows, unless a higher standard-of-care is determined necessary per item A:

1. Unpainted, interior, dry exposure surfaces need not be primed.
2. Finished painted, interior, dry exposure surfaces:
   a. Surface Preparation: SSPC-SP2 Hand-Tool and/or SP3 Power-

Tool Cleaning. Apply Primer Type A. Field touchup with same primer.

b. Where jobsite exposure is expected to exceed 6 months, SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning is required. Apply Primer Type B or C. Field touchup with same primer.

3. Finish painted surfaces with exterior exposure, interior exposure subject to wet conditions or fumes, or surfaces to receive high performance finish coatings (for example epoxy or urethane coatings.
   a. Surface Preparation: SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning to create a dense, uniform angular surface profile of 2.0 mils minimum. For severe (immersion) exposure, SSPC-SP10 / NACE No. 2 Near-White Blast-Cleaning is required.
   b. Apply Primer Type B. Field touchup with same primer.
4. Surfaces to be fire proofed need not be primed unless required by the fireproofing manufacturer or if jobsite exposure is expected to be inclement per item A. Where unprimed steel is to receive fireproofing, prepare steel surface as required by fireproofing manufacturer. If fireproofed surfaces are to be primed, provide primer as follows:
   a. Surface Preparation: SSPC-SP3 Power-Tool Cleaning.
   b. Apply Primer Type C. Field touchup with same primer.
5. Exterior exposed (unpainted) surfaces and as otherwise indicated to receive galvanizing:
   a. Galvanize per ASTM A123 Class 55 minimum. Passivation agents are not permitted on galvanized metal that is to be painted. Provide vent holes per ASTM A385 at closed sections (such as HSS). Submit proposed location of vent holes for review by Engineer.
   b. Connection hardware shall be hot-dip galvanized per ASTM A153 or F2329. Grade A325 high-strength bolt assemblies may be mechanically galvanized per ASTM B695 class 55 or hot-dip galvanized per ASTM F2329. Mating bolts and nuts shall receive the same zinc-coating process.
   c. Repair all uncoated, damaged, or altered galvanized surfaces per ASTM A780.

C. Do not prime the following surfaces unless otherwise indicated:

1. Connections to be field welded.
2. Steel in contact with concrete.
3. Surfaces to receive welded metal decking.

D. Slip critical bolted connection surfaces shall either be unfinished & prepared per the RCSC or primed per item B3 or B4.

E. Do not cover up work with finish materials until inspection is complete and work is approved by the Testing Agency.

2.5 SOURCE QUALITY CONTROL

A. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01.

B. Steel Materials Testing:

1. No testing is required for materials identified in accordance with CBC Section 2202A.1 (heat number, grade stencil, etc.).
2. Unidentified steel- General: Test all structural shapes. In addition, test to verify Fy and Fu values when engineering requirements exceed Fy = 25 ksi for design.
3. Charpy V-Notch (CVN) testing requirements are per AISC 341. Heavy sections requiring CVN testing are indicated on the documents.

C. Shop Welding Inspection:

1. Testing Agency shall inspect and certify all structural welds.
2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.
3. Welding Inspection: Continuous inspection required unless otherwise noted below. Comply with requirements of AWS D1.1, AWS D1.8 and AISC 341.
   a. Welding Inspector shall check all welds, materials, equipment and procedures.
   b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.
   c. Welding Inspector shall use radiographic, ultrasonic, magnetic particle, or any other necessary aid to visual inspection to assure adequacy of welds. Ultrasonic Testing (UT) shall be required for all complete joint penetration (CJP) welds of material 5/16 inch thick or greater.
4. Periodic Inspection Acceptable:
   a. Single pass fillet welds not exceeding 5/16 inch.
   b. Welding of studs to beams.

D. Bolts, Nuts and Washers: Provide samples to Testing Agency for required testing, at no additional cost.

E. High Strength Bolted Connections: Provide testing and verification of shop-bolted connections in accordance with RCSC specifications. Test all bolts at each connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Framing:
1. Erect all structural steel true and plumb.

2. Verify proper final alignment prior to making final connections.

C. Field Connections:

1. Workmanship of field bolted and welded connections shall conform in all respects to methods and tolerances specified for fabrication.
2. Field weld components indicated on shop drawings. Sequence field welds to minimize built-up stress and distortion of the structural frame. Verify sequence with Engineer. Coordinate field welding schedule with Testing Laboratory.
3. Welded Studs: Install in accordance with manufacturer's instructions and structural welding code AWS D1.1 and AWS D1.8.

D. Templates: Provide bolt setting templates for all anchor bolts. Provide instructions for the setting of anchors and bearing plates, verify these items are set correctly as work progresses.

E. Column base plates: Set level to correct elevations, support temporarily on steel wedges, shims, or leveling nuts where shown, until the supported members are plumbed and base plate is grouted.

1. Grout solid the full bearing area under base plates prior to installation of floor and/or roof decks.
2. Comply with manufacturer's instructions for high strength grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

F. Bolting - General:

1. Inspect mating surfaces to ensure that bolt head and nut will have full bearing and that metal plies will mate flush between bolts.
2. Install bolts in matching holes. Do not distort metal or enlarge holes by drifting during assembly. Remake mismatched components to achieve tolerances indicated.
3. Holes mismatched in excess of 1/8 inch will be rejected.
4. Holes mismatched less than 1/8 inch may be reamed to the next larger size bolt.
5. Do not enlarge holes by flame cutting or air/arc (“plasma“) cutting.
6. Provide flat washer(s) at over-size holes.
7. Provide washers for all conditions per RCSC Section 6 and under nuts to connected parts less than ¼ inch thick.
8. Provide ASTM F436 beveled washers when the slope of the surfaces of parts in contact with the bolt head or nut is greater than 1:20.
9. Do not install bolts with damaged threads.
10. Threads shall commence outside of the shear plane where noted as HSB-X on drawings..

G. Bolting - Specific:

1. Machine Bolts (MB): Install and tighten to a snug condition (ST) such that laminated surfaces bear fully on one another, using an impact wrench or “full effort” of an installer using a standard spud wrench.
2. High Strength Bolts in Bearing/Shear or Static Tension joints snug tight

(ST):
a. Provide a hardened washer at the head/nut at slotted holes
b. Install and tighten as per Machine Bolts (MB) snug tight (ST) and other requirements of RCSC specification Section 8.
c. Use ASTM F436 washer only in snug tight connections with static tension loads.

3. High Strength Bolts in Pretensioned joints (PT):
a. Provide ASTM F436 washer per requirements of RCSC Section 6.
b. Install and tighten in accordance with the requirements of RCSC Section 8.
c. Install bolts in all holes of the joint and compact the joint until the connected plies are in firm contact prior to pretensioning.
d. The following tightening methods and bolt type are acceptable for PT joints:
(a) Turn-of-the-nut pretensioning method
(b) Calibrated wrench pretensioning method
(c) Twist-off-type tension-control bolts
(d) Direct-tension-indicator washer pretensioning method.

4. High Strength Bolts in Slip Critical (SC) joints:
a. Provide tensioning for High Strength Bolts (PT) per above.
b. Faying surfaces to be prepared per RCSC Section 3 and PART 2.

H. Supports, Shoring and Bracing: Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Conform to requirements of all applicable laws and governing safety regulations. Resist imposed loads, including those of stored materials and equipment.

1. Provide all temporary supports, shoring and bracing necessary to achieve work of tolerances indicated.
2. Provide all necessary temporary flooring, planking and scaffolding required for erection of steel, and support of erection machinery.
3. Construction Loading: Do not overload the structure or temporary supports with stored materials, equipment or other loads.
4. Maintain temporary bracing and shoring until work is complete, and longer as required to ensure stability and safety of structure.

I. Do not make final connections until structure is aligned to meet specified tolerances.

3.3 ERECTION TOLERANCES

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

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. The independent Testing Agency will perform field quality control tests, as specified in pertinent sections of Division 01.

B. Field Welding Inspection: Conform to all requirements of section SOURCE

QUALITY CONTROL.

C. High Strength Bolting: Provide testing and verification of field-bolted connections in accordance with RCSC Section 9.

1. Inspect mating surfaces.
2. Test all materials prior to use. Use only materials meeting specified requirements.
3. Inspector shall review installation and verify “full effort” with installers for ST joints and shall randomly manually verify “full effort” on 10 percent of installed bolts.
4. Inspector shall verify installation for 100% of SC and PT joints.
5. Review installation procedures for all types of HSB joints and verify installation of “Twist-off” and load-indicator type bolts.
6. If any bolt fails testing, all bolts at the joint shall be loosened and re-tightened. Exception: Galvanized bolts shall be replaced prior to re-testing.

D. Welded Studs: Test headed studs electro-magnetically welded through metal deck to directly to steel members as follows:

1. Install minimum of two trial studs.
2. Testing Agency shall bend studs with a hammer to minimum 30 degrees out of axis.
3. Any failure shall require new studs be welded for another test and welding apparatus adjusted.

3.5 ADJUSTING

A. Touch-up damaged finishes with compatible specified primer.

B. Replace defective or damaged work with conforming work. Replace all defective work at Contractor's expense.

C. Straighten materials by means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

F. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

G. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

3.6 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection; leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.

B. Protect work from damage by subsequent operations.

END OF SECTION

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SECTION 05 12 10

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide architecturally exposed structural steel (AESS) at exterior structural steel wide flange columns and double channel columns; requirements are in addition to structural steel requirements.

1. AESS shall comply with requirements specified for structural steel.

2. Provide complete AESS work including fabrication, transportation, assembly, erection, and any other endeavor required to provide complete AESS in conformance with Contract Documents.

B. Related Sections:

1. Section 05 12 00: Structural steel framing.
2. Section 05 50 00: Miscellaneous metal fabrications.
3. Section 09 96 70: High performance coating.

1.2 REFERENCES

A. American Institute for Steel Construction AISC 303, Chapter 10: Architecturally Exposed Structural Steel.

1. Responsibility of accuracy of shop drawings rests with Contractor, regardless of wording in references.

B. American Welding Society (AWS): D1.1 Structural Welding Code - Steel.

1.3 SUBMITTALS

A. General: Submit information required for structural steel.

B. Shop Drawings: In addition to requirements for structural steel, submit following information to Architect.

1. Indicate type and location of AESS shop and field connections; location, type, size, and extent of welds (spot welds or continuous welds).

2. Indicate location, size, and spacing of bolts and holes in AESS.

3. Review of shop drawings will cover only general scheme, design, and character of details, but not checking of dimensions.

a. This review will not relieve Contractor from responsibility for executing work in accordance with Contract Documents.

C. Samples: Submit samples of materials, shapes, finishes and connections, including one sample of each primary type of AESS and each type of weld.

1. Furnish sample with one half with surface preparation and specified primer.

2. Ship samples weighing over 15 pounds to Project field office for review; do not send to Architect's office.

1.4 QUALITY ASSURANCE

A. Qualification of AESS Welders: Welders shall have not less than five years successful experience welding architecturally exposed structural steel.

1. Welds shall be judged by appearance as well as performance with welds smooth, uniform, and free of voids and irregularities inconsistent with concept of architecturally exposed structural steel.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Before and during erection, keep AESS clean.

B. Ship, handle, and store AESS in manner to keep clean and to avoid damage to members; members showing evidence of rough handling or damage will be rejected; prevent bends, twists, and distortions.

C. Store steel materials, both plane and fabricated, above ground on platforms, pallets, skids, or other supports.

D. Keep AESS free from dirt, grease, and other foreign matter.

E. Protect AESS from corrosion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide architecturally exposed structural steel (AESS); requirements are in addition to structural steel requirements.

B. Performance Criteria: Comply with requirements for structural steel.

C. Design Requirements: AESS to be new, free of defects which may impair strength, functioning, durability, and which may impair appearance of AESS and related work.

D. Exposed Structural Steel Finish: Comply with structural requirements for structural steel and with AISC 303 Chapter 10 requirements for Architecturally Exposed Structural Steel Categories as follows.

1. Category AESS 3 – AESS Elements in Close View: Provide where AESS is viewed from distance of less than 20'.

E. Architecturally Exposed Structural Steel (AESS) Components: Unless otherwise required by structural steel specifications.

F. Fasteners: Refer to Structural Steel Drawings.

G. Miscellaneous Items: Furnish miscellaneous structural steel items and related components required to complete AESS in accordance with intent of Contract Documents requirements for AESS.

H. Prime Painting: Shop prime AESS unless otherwise indicated. Provide primers compatible with finish paints specified in Section 09 96 70 – High Performance Coating.

2.2 FABRICATION

A. AESS Fabrication: Comply with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".

1. Fabrication and assembly shall be executed in shop to fullest extent practicable.

2. Work not shop-assembled shall be shop-fitted.

3. Secure field measurements required for proper, adequate fabrication and installation of AESS; exact measurements shall be Contractor's responsibility.

B. Straighten column base plates by pressing to provide satisfactory contact bearing between plate and column for plane bearing surfaces for full contact.

C. (Not Used)

D. Holes: Cut, drill or punch holes for bolts and as required; do not make or enlarge holes by burning, drill holes in bearing plates.

1. Provide holes in members to permit connecting work of other trades.

2. Holes shall be clean-cut without torn or ragged edges.

3. Remove outside burrs resulting from drilling and reaming operations with tool making 1/16" bevel.

E. Shop Connections: Use HS A325 fasteners where not otherwise indicated; conform to standards of AISC "Manual of Steel Construction," for joining members.

1. Make connections capable of accommodating reaction from total allowable load to smaller member.

F. Shop and Field Welding: Comply with AWS. Weld by shielded arc method or submerged arc method; flux cored arc method and other methods approved by AWS subject to special review and approval based in part on appearance.

1. Welding of AESS shall be done in manner and by persons capable of providing smooth uniform welds free of voids and irregularities.

2. Use AWS minimum weld size, but not less than 3/16" fillet welds where sizes are not shown on Drawings.

3. Radius of Welds: 3/16” unless otherwise directed.

G. High Strength Bolts: “Bearing type” connections with threads excluded from shear plane, unless otherwise indicated.

1. Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."

2. Use "Direct Tension Indicator Method" of installation in accordance with manufacturers printed instructions.

H. Prior to fabrication, straighten material by methods that will not injure materials.

I. Prior to assembling component parts of connection, thoroughly clean contact surfaces of loose scale, rust and burrs and remove local twists and bends.

J. Provide holes required for other work secured to or passing through AESS in accordance with approved shop drawings.

K. Surface Preparation: After fabrication, inspection, and acceptance, and before shipping, clean steel to be encased in concrete or fireproofing of loose mill scale, rust, weld slag or flux deposit, dirt, and foreign matter.

1. Remove burrs and fill gouges with weld and grind flush. Remove oil and grease deposits by solvent. Grind exposed body filler and dress smooth and flush within profiles indicated on Drawings.

2. Comply with Steel Structures Painting Council Specification SSPC-SP-10, "Near White Blast Cleaning."

3. Grind smooth irregular ends including those resulting from cutting and burning operations.

4. Grind smooth welds to provide clean smooth surface.

5. Clean and grind areas subject to ultrasonic or radiographic inspection.

6. Surfaces within 2" of field weld location shall be free of materials that could prevent proper welding or produce objectionable fumes during welding.

L. Mark each member with erection identification corresponding to mark on erection drawings.

2.3 SHOP PRIME PAINTING

A. Shop prime AESS exposed to view in completed Work only.

B. Shop prime paint structural steel with one coat of primer, including parts of braces, brackets, and similar work.

1. Do not shop prime surfaces to be machined, contact surfaces and edges and surface areas adjacent to field welds.

C. Touch-Up: In shop, after assembly, and in field, after installation of AESS, touch-up damaged and abraded portions of shop prime paint with specified primer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions and surfaces receiving or affecting AESS; do not proceed until unsuitable conditions have been corrected.

1. Provide for in-place tolerances of building structure and other construction that interfaces with AESS.

B. Unsuitable conditions include, without limitation, steel work that has not been inspected, tested, and accepted and preparatory work that does not conform to requirements of this section.

C. Beginning of AESS erection constitutes acceptance of building structure and interfacing construction.

3.2 ERECTION

A. Surveys: Employ registered professional engineer or land surveyor, experienced in survey work, to establish permanent benchmarks as shown and as required for accurate erection of AESS.

1. Check elevations of bearing surfaces and location of anchor bolts and similar devices before erection starts.

2. Report discrepancies to Architect do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.

B. Carefully plan erection of structural steel so no cutting and removal of material will be necessary; do not torch burn in field, except in areas to be fully concealed in Project and as approved by Architect

1. Do not use materials, equipment or practices that could adversely affect functioning, appearance, and durability of completed AESS and related construction.

2. Install AESS without buckling, opening of joints, opening of welds, or other harmful effects.

3. Match materials to produce continuity of line, texture, and color.

4. Provide for cutting and welding for attachment of other work in contact with AESS where required for proper subsequent installation of other work.

5. Make provision in AESS for support of other materials and as required for completion of Project; AESS members shall not have holes except where required, detailed, and approved.

C. Bracing and Shoring: Provide bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made, and until lateral forces resisting elements can brace structure.

1. Maintain AESS plumb, level, and true.

D. Bases and Bearing Plates: Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond, clean bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

2. Tighten anchor bolts after supported members have been positioned and plumbed, do not remove wedges or shims, but, if protruding, cut off flush with base or bearing plate before grouting.

E. Field Assembly: Set AESS accurately to lines and elevations indicated; align and adjust various members forming part of complete frame or structure before permanently fastening.

1. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.

2. Perform adjustments to compensate for discrepancies in elevations and alignment.

3. Level, plumb and align individual members of structure within specified AISC tolerances, drifting to enlarge unfair holes is not permitted.

F. Connections: Fabricator shall be responsible for detailing connections in accordance with current requirements of AISC.

1. Detail full moment capacities of members where moment connections are indicated on Drawings.

2. Grade of connection material shall be same as connecting member unless otherwise shown on Drawings or unless it can be shown by calculations that lower grade steel is adequate.

3. Make member splices with full penetration welds to develop full capacity of member unless otherwise shown on Drawings.

4. Welds in built-up AESS members shall be continuous unless otherwise shown on Drawings and shall be designed to transfer all stresses caused by forces on members framing into built-up members.

G. AESS Tolerances: AESS shall be plumb, square, level, and correctly aligned within limitations described in "Specification for Architecturally Exposed Structural Steel".

H. Installation of AESS shall be sound, watertight, and free from defects in materials and workmanship.

3.3 WELDING

A. General: Conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings," AWS "Code for Welding in Building Construction," and requirements of this section.

1. Location and type of welds shall be as indicated, make no other welded splices, except those indicated.

B. Preparation of Surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint, and other foreign materials.

C. Equipment: Use equipment with devices to regulate speed and manually adjust operating amperage and voltage; amperage capacity shall be sufficient to overcome line drop and to give adequate welding heat.

D. Remove run-off tabs and grind surfaces smooth where tabs could interfere with fireproofing and architectural treatment.

E. Automatic End Welded Studs: Automatically end weld in accordance with manufacturer's recommendations to provide complete fusion between end of stud and plate.

1. There shall be no porosity or evidence of lack of fusion between welded end of stud and plate.

2. Stud shall increase in length during welding approximately 1/8" for 5/8" diameter and under, and 3/16" for over 5/8" diameter.

F. Assemble and weld butt-up sections by methods that will produce true alignment of axes without warp; minimize shrinkage strains in welded joints by proper welding techniques including preheating as necessary.

1. Steel with lamellar tearing shall be rejected and replaced without additional cost to Owner.

3.4 CLEANING AND PROTECTION

A. Clean AESS. Clean is defined as free of substances that cannot be removed by normal cleaning with detergent and water.

B. Protect AESS from materials, equipment, and practices that could impair functioning, appearance, or durability of AESS or other construction.

C. Remove and replace or repair AESS damaged prior to Substantial Completion to satisfaction of Architect.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide stock and custom fabricated metal items scheduled at end of this Section, complete in respect to function as intended.

1. Metal fabrications includes items made from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel or metal systems specified elsewhere.

B. Related Sections:

1. Section 05 12 10: Architecturally exposed structural steel.
2. Section 05 70 00: Decorative metal including blackened steel trim.
3. Section 12 35 53: Manufactured laboratory metal casework.

1.2 REFERENCES

A. American Welding Society (AWS): D1.1, Structural Welding Code.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature for products used in metal fabrications, including paint, grout, and manufactured items.

B. Shop Drawings: Submit for fabrication and erection of metal fabrications. Indicate profiles, sizes, connection, reinforcing and anchorage.

1. Provide templates for anchorage installation by others.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide stock and custom fabricated metal items.

B. Steel Shapes, Plates and Bars: ASTM A36.

C. Structural Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A1008, Class 1; of grade required for design loading.

D. Steel Pipe: ASTM A53, Type S seamless, grade as selected by fabricator and as required for design loading; minimum standard weight, STD, or Schedule 40.

E. Steel Tubing: Cold formed ASTM A500; or hot rolled, ASTM A501; minimum Grade B; seamless where exposed.

F. Castings: Gray iron, ASTM A48, Class 30; malleable iron, ASTM A47.

G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron ASTM A47, or cast steel ASTM A27. Provide bolts, washers and shims as required, hot-dipped galvanized, ASTM A153.

H. Grout: Non-shrink meeting ASTM C1107, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.

I. Fasteners and Rough Hardware: Type required for specific usage; provide zinc-coated fasteners for exterior use or where built into exterior walls.

J. Welding Materials: AWS D1.1, type required for materials being welded.

K. Paint: Provide primers as recommended by paint manufacturers for substrates and paints specified in Section 09 90 00 – Painting and Coating.

1. Galvanizing Repair Paint: High zinc-dust content paint for regalvanizing welds in galvanized steel.

2.2 FABRICATION

A. Fabricate items with joints neatly fitted and properly secured.

B. Grind exposed welds continuous, smooth, and flush with adjacent finished surfaces, and ease exposed edges to approximate 1/32" uniform radius.

C. Exposed Mechanical Fastenings: Flush countersunk fasteners unobtrusively located, consistent with design of structure.

D. Fit and shop assemble in largest practical sections for delivery.

E. Make exposed joints flush butt type, hairline joints where mechanically fastened.

1. Fabricate joints exposed to weather in manner to exclude water or provide weep holes where water could accumulate.

F. Supply components required for proper anchorage of metal fabrications; fabricate anchorage and related components of same material and finish as metal fabrication.

G. Ladders: Comply with requirements of ANSI A14.3 and Cal/OSHA; Contractor option steel or aluminum.

1. Rungs: Fit in centerline of side rails, plug weld and grind smooth on outer rail faces; provide non-slip surface on top of rung, similar to epoxy resin and aluminum oxide granules surface.

2. Personal Fall Arrest Systems: Provide system on ladder designed to stop a fall before person contacts a lower level where required for specific ladder applications; system to be acceptable to authorities having jurisdiction.

H. Steel Bollards: Minimum Schedule 80 seamless steel piping, filled with minimum 2000-psi concrete.

1. Removable Bollards: As indicated; provide steel piping without concrete fill, fitted with hasp and eye to allow for Owner furnished padlocks to prevent unauthorized removal; cap top end of pipe with flush, welded end cap; bottom open.

I. Steel Supports Indicated for Laboratory Epoxy Countertops: Welded construction in configurations indicated and capable of supporting epoxy countertops indicated.

1. Coordinate with Section 12 31 00 – Manufactured Laboratory Cabinets.

J. Pre-Engineered Support Systems: Provide manufactured pre-engineered support system consisting of channel supports with anchors, attachments, and accessories as required for complete installation. Sizes to support anticipated loads.

1. Manufacturers:

a. Unistrut Inc./Unistrut.
b. Grinnell Corp./PowerStrut.
c. Thomas & Betts, Inc./Superstrut.
d. Substitutions: Refer to Section 01 25 00.

2. Finish: Manufacturer’s standard prime paint finish for channel supports; galvanized or similar plated anchors and fasteners; hot dip galvanized where at exterior and exterior exposed applications.

K. Finishes: Galvanize and prime paint exterior work and prime paint interior work unless otherwise noted in Schedule; comply with requirements of Section 09 90 00 - Painting and Coating for preparation and priming.

1. Thoroughly clean surfaces of rust, scale, grease, and foreign matter prior to applying finish.

2. Do not shop prime surfaces in contact with concrete or requiring field welding; shop prime in one coat.

3. Galvanized Coating: Provide coating comparable to ASTM A924 and A653, minimum G90 hot dip galvanized coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary.

3.2 ERECTION

A. Obtain Architect's review prior to site cutting and adjusting which are not part of scheduled work.

1. Perform cutting and altering for installation and coordination with other work.

B. Install items square and level, accurately fitted and free from distortion or defects detrimental to appearance or performance.

1. Supply items required to be cast into or embedded in other materials to appropriate trades.

2. Ensure alignment with adjacent construction; coordinate with related work to ensure no interruption in installation.

C. Make provision for erection stresses by temporary bracing; keep work in alignment.

D. Field bolt and weld to match standard of shop bolting and welding; hide bolts and screws whenever possible, where not hidden, use flush countersunk fastenings.

1. Perform field welding in accordance with AWS D1.1.

E. After installation, touch-up field welds and scratched and damaged surfaces; use primer consistent with shop coat or recommended for galvanized surfaces, as applicable.

F. Replace items damaged in course of installation and construction.

3.3 SCHEDULE

A. Supply and install metal fabrications listed in Schedule, complete with anchorage and attachments necessary for installation.

1. Schedule lists principal items only, refer to Drawings for items not listed.

B. Schedule:

1. Miscellaneous angles, plates, and attachments to be set in concrete or masonry for anchorage of other items.

2. Iron and steel shapes, sleeves, anchors, connectors, and fastenings required to complete construction work, and which are not provided in other Specification sections.

a. Rough hardware, including bolts, fabricated plates, anchors, hangers, dowels, and miscellaneous metals.

b. Angle and channel frames for doors and wall openings.

c. Beams of structural shapes not supported by structural steel.

3. Ladders.

4. Steel bollards.

5. Steel supports for epoxy laboratory countertops.

6. Pre-engineered support systems.

END OF SECTION

SECTION 05 70 00

DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide decorative (ornamental) metal items including attachment devices and accessories, as required for complete, finished installation.

1. Provide custom blackened steel trim items indicated.

B. Related Work:

1. Section 05 12 10: Architecturally exposed structural steel columns.

1.2 REFERENCES

A. National Association of Architectural Metal Manufacturers: Metal Finishes Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate decorative metal trim with adjacent materials especially architectural woodwork in Section 06 40 00 – Architectural Woodwork.

B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature including recommendations for cleaning.

B. Shop Drawings: Show detailing including anchorage, accessories, and supporting members.

C. Samples: Furnish samples of each exposed metal finish.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm with minimum five years successful experience fabricating decorative metal items like those required for Project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide decorative (ornamental) metal items specified including attachment devices and accessories.

B. Decorative Steel:

1. Steel Shapes, Plates and Bars: ASTM A36.

2. Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A1008, Class 1; of grade required for design loading.

3. Blackened Steel Finish: Provide black oxide finish using passivation process to protect steel from rust by forming magnetite on exposed steel surfaces using traditional caustic process of alkali salt solution at elevated temperatures.

a. Clear Coating: Provide premium quality polyurethane or acrylic urethane coating for durable protective coating of blackened steel; prepare steel and apply coating in accordance with coating manufacturer recommendations.

b. Final Appearance: As approved by Architect; match Architect's sample.

C. Brackets and Anchors: Unexposed plates, angles and supports may be steel; exposed items to match decorative metal type and finish.

D. Fasteners: Type required for specific usage; provide concealed fasteners except where specifically approved, where exposed match type and finish of metal being fastened.

1. Concealed Steel Fasteners: Hot-dipped galvanized minimum G90 where built into exterior walls or subject to high humidity.

2.2 FABRICATION

A. Fabricate component connections to support specified design loads.

B. Select materials for straightness, free of defects and irregularities.

1. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning," stains, discolorations, and imperfections on finished units are not acceptable.

C. Make exposed joints flush butt type, hairline joints where mechanically fastened; provide concealed connection devices with hidden fasteners.

1. Fabricate continuous items with joints neatly fitted and secured.

2. Ease exposed edges to approximate 1/32" uniform radius.

3. Fabricate joints exposed to weather in manner to exclude water or provide weep holes where water could accumulate.

D. Comply with AWS for recommended practices in welding each type of material; provide welds behind finished surfaces without distortion or discoloration on exposed side; dress exposed and contact surfaces.

E. Exposed Mechanical Fastenings: Flush countersunk fasteners unobtrusively located, consistent with design of structure; blackened pan-head fasteners where exposed.

F. Fit and shop assemble in largest practical sections for site delivery.

G. Separate dissimilar materials with bituminous paint where concealed, with preformed separators, or similar method to prevent corrosion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary.

3.2 INSTALLATION

A. Install decorative metal items in accordance with manufacturer's recommendations, installation instructions, and approved shop drawings.

B. Install plumb, true and in correct relation to adjacent work, free from distortion or defects detrimental to appearance and performance.

C. Prior to securing continuous items, adjust to ensure proper matching at butt joints and correct alignment throughout their length.

D. Tolerances: Accurately align and locate components to column lines and floor levels; adjust work to conform to following tolerances.

1. Plumb: 1/8" in 10'-0"; 1/4" in 40'-0"; non-cumulative.

2. Level: 1/8" in 20'-0"; 1/4" in 40'-0"; non-cumulative.

3. Alignment: Limit offset to 1/16" where surfaces are flush or less than 1/2" out of flush and separated by less than 2" (by reveal or protruding work); otherwise limit offsets to 1/8".

4. Location: 3/8" maximum deviation from measured theoretical location (any member, and location).

E. Install anchorage devices to secure and rigidly fasten system to building.

F. Provide anchors to be installed in other work, and setting details, in time for proper installation by trades concerned; verify correct placement.

3.3 CLEANING

A. Clean decorative metal surfaces promptly after installation of components, exercising care to avoid damage of finish.

B. Remove excess sealant compounds, dirt, and other foreign substances.

3.4 PROTECTION

A. Repair or replace items damaged or marred during construction.

END OF SECTION

SECTION 05 70 05

LANDSCAPE METALWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all labor, materials and equipment as required for complete, finished installation of metalwork as shown on the drawings and specified including the following items:
   1. Railings
   2. Skate Deterrents
   3. Miscellaneous landscape metal including anchors and bolts.

B. Metal fabrication includes plates, bars, strips, tubes, pipes and castings made from iron and steel that are not specifically listed herein.

1.2 REFERENCES AND STANDARDS

A. "Code for Arc and Gas Welding in Building Construction" of American Welding Society, AWSD1.1, latest edition, with current supplements and addenda, is hereby made a part of this Section and miscellaneous metalwork shall conform to the applicable requirements therein, except as otherwise specified herein or shown on the drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements or governing rules and regulations.

B. All work shall conform to the American Institute of Steel Construction Specifications for design, erection and fabrication, and acceptable standards of good practice. Finished members shall be true to line and free from twists and bends.

C. SSPC "Steel Structures Painting Manual, Volume 2, Systems and Specifications".

D. National Association of Architectural Metal Manufacturers (NAAMM): Metal Finishes Manual

1.3 SUBMITTALS, per Section 01 30 00

A. Product Data: Furnish manufacturer’s literature including paint, grout and recommendations for cleaning.

B. Shop Drawings: Shall show dimensions, sizes, thicknesses, gauges, finishes, joining attachments and relationship of work to adjoining construction. Where items must fit and coordinate with finished surfaces and/or constructed spaces, take measurements at site and not from drawings. Where concrete, masonry or other materials must be set to exact locations to receive work, furnish assistance and directions necessary to permit other trades to properly locate their work.

Where welded connectors, concrete or masonry inserts are required to receive work, shop drawings shall show exact locations required, and all such drawings shall be furnished to the trades responsible for installing the connectors or inserts. Catalogue work sheets showing illustrated cuts of item to be furnished, scale details and dimensions may be submitted for standard manufactured items.
1. Provide templates for anchorage installations by others.

C. Samples: Furnish finish samples of stainless steel skate deterrents.

D. Certificates: Submit certification signed by California registered civil or structural engineer indicating compliance with Contract Documents and code requirements where required.

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Drawings indicate metal sizes and shapes; unless otherwise specifically indicated, design components and fabrications of gauges and thicknesses to withstand anticipated loads as required by California Building Code.
1. Railings: Support a lateral force of 50 lbs./lin. Ft. uniform load and 200 lbs. at any single point without permanent set or damage; ASTM E 935.
a. Top Rails: Design to support minimum 200 lb. concentrated single point load applied at any point vertically or horizontally.

B. Rail Regulatory Requirements:
1. Access: Comply with California Building Code and Americans with Disabilities Act Accessibility Guidelines (ADAAG) Access Requirements and finishes as designated by NAAMM “Metal Finishes Manual” and “Pipe Railing Manual” and referenced standards. Rails shall be welded construction; cap exposed ends.
2. Building Code: Comply with requirements of applicable building codes for railing design, except where more restrictive codes are specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm with minimum five years successful experience fabricating metal items similar to those required for Project.

PART 2 - MATERIALS

2.1 BASIC MATERIALS AND ACCESSORIES

A. Steel Tubing: ASTM A500 (cold-formed), Minimum Grade B, seamless where exposed.

B. Steel Pipe: ASTM A53, Type S, seamless, Grade B, minimum standard weight, STD or Schedule 40, unless otherwise noted.

C. Miscellaneous steel plates and structural steel shapes conforming to ASTM A36- (latest edition).

D. Bolts: Structural grade steel, ASTM A307-(latest edition), with suitable hex nuts and washers, all galvanized except where noted otherwise.

E. Structural Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A 1008, Class 1 of grade required for design loading.

F. Castings: Gray iron, ASTM A 48, Class 30; malleable iron, ASTM A47.

G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron ASTM A47 or cast steel ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.

H. Fasteners and Rough Hardware: Type as required for specific usage; provide zinc-coated fasteners for exterior use or where built into exterior walls.

I. Welding Materials: AWS D1.1, type required for materials being welded.

J. Stainless Steel
1. Plate, Sheet and Strip: ASTM A167, Type 316. Provide mill finish unless otherwise shown.
2. Bars and Shapes: ASTM A276, Type 316. Provide mill finish unless otherwise shown.
3. Tubing: ASTM A269
4. Stainless Steel Railing Finishes: Submit finish sample for approval. Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated free of cross scratches. Run grain with long dimension of each piece.
5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

K. Screws: Galvanized zinc, electro-plated or brass.

L. Welding Electrodes: As permitted by AWS A5.

M. Non-Metallic Shrinkage Resistant Grout: Premixed, nonmetallic, non-corrosive, non-staining, shrinkage resistant product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621 and ASTM C1107, free of gas-producing or gas-releasing agents, oxidizing catalysts, inorganic accelerators and chlorides. Provide one of the following:
1. "Five Star Grout" (U.S. Grout Corp.).
2. "Masterflow 713" (Master Builders Co.).
3. "Crystex" (L&M Construction Chemicals, Inc.).

N. Fasteners and Anchorage Devices: Provide fasteners complying with the requirements of Industrial Fasteners Institute standards. Type, grade, class and style best suited for the respective purpose. Use countersunk flat-head Phillips type machine screws for exposed fasteners, except where Allen head screws are required. Use galvanized steel or stainless steel fasteners for exterior construction and for fastening components fabricated of galvanized steel except where specified otherwise. Fasteners exposed in finish surfaces to match finish of adjacent surfaces.

O. Component Connections: Fabricate component connections to support specified design loads.

P. Material Selection: Select materials for straightness, free of defects and irregularities.
1. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, “oil canning”, stains, discolorations, and imperfections on finished units are not acceptable.

Q. Joints: Make exposed joints flush butt type, hairline joints where mechanically fastened; provide concealed connection devices with hidden fasteners.
1. Fabricate continuous items with joints neatly fitted and secured.
2. Ease exposed edges to approximate 1/32” uniform radius.
3. Fabricate joints exposed to weather in manner to exclude water or provide weep holes where water could accumulate.

R. Welding: Comply with AWS for recommended practices in welding each type of material; provide welds behind finished surfaces without distortion or discoloration on exposed side; dress exposed and contact surfaces.

S. Exposed Mechanical Fastenings: Flush countersunk fasteners unobtrusively located, consistent with design of structure.

T. Assemblage: fit and shop assemble in largest practical sections for site delivery.

U. Dissimilar Materials: Separate dissimilar materials with bituminous paint where concealed, with preformed separators, or similar method to prevent corrosion.

2.2 SPECIALLY FABRICATED PRODUCTS

A. Railings and Handrails: Make all bar railings of milled steel unless noted otherwise; all connections welded. Where pipe railing are required, make from (1-1/2) outside diameter seamless steel pipe unless noted otherwise. Fabricate in largest sections feasible; all shop joints welded; all field joints with concealed sleeves and pins.
1. 1.5” O.D. Stainless Steel Tube Steel Handrail and Posts, 0.12” wall thickness

B. Railings and Handrails Design: Continuous railings conforming to applicable code and design requirements. Construct to support a concentrated load of 250 lbs. Applied at any point and in any direction and for a uniform load of 50 lbs. Per foot applied in any direction. The concentrated and uniform loading conditions shall not be applied simultaneously.
1. Wall Rail Brackets: Castings as accepted by Owner’s Representative.
2. Wall returns: 90 degree elbow return with ¼” maximum clearance unless otherwise indicated.
3. Provide wall plates only where indicated and where required by applicable codes.

2.3 SHOP PAINTING

A. General:
1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded unless otherwise specified.
2. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning", prior to any additional surface preparation specified.
3. Clean and prepare metal surfaces before applying shop coat. Remove rust and mill scale in accordance with SSPC SP-3 "Power Tool Cleaning".
4. Immediately after surface preparation, apply primer in accordance with manufacturer's instructions. Use painting methods which will result in full coverage and dry film thickness specified.
5. Apply one shop coat of primer to fabricated metal items, except apply 2 coats of primer to surfaces inaccessible after assembly or erection. In addition, apply one shop coat of finish paint to entire surfaces of exterior loose lintels, shelf and relieving angles, dunnage and other items as noted or specified. Change color of second or finish coat to distinguish it from the first coat.
6. Separate dissimilar metals with one coat of dielectric separator. Do not extend coating onto exposed or finished surfaces.
7. Application: Do not paint when ambient temperature is below 40°F. Paint in dry weather or under cover; paint over dry rust-free surfaces. Stir paint and keep at uniform consistency during application. Apply paint by brush or spray per manufacturer's directions to a dry film thickness of not less than 1.5 mils (approximately 370-375 SF of surface per gallon); do not thin paint in excess of manufacturer's recommendations. Allow paint to dry before handling or shipment.

B. Fully Concealed Items:
1. Clean steel work by "Solvent Cleaning" method specified in SSPC-SP 1, followed by "Hand Tool Cleaning" to remove loose mill scale and rust by methods specified in SSPC-SP 2.
2. Apply ferrous metal primer immediately after cleaning to uniform dry film thickness of 2.0 mils.
3. Apply second coat of same primer and same thickness on concealed work which will be built into below grade work, or will be concealed in areas designated high humidity areas.

C. Exposed Exterior Items:
1. Apply the following cleaning, treatment and painting to exterior work which will be fully exposed or only partially exposed, and to exposed interior work in areas designated as high humidity areas.
2. Clean by "Solvent Cleaning" method specified in SSPC-SP 1, followed by "Power Tool Cleaning" to remove loose mill scale and rust by methods specified in SSPC-SP 3, followed by "Pickling" to remove remaining mill scale and rust by methods specified in SSPC-SP 8. Power tool cleaning and pickling may be omitted from work fabricated from cold-rolled or cold-finished stock, and from castings, provided surfaces are not heavily rusted.
3. Apply pretreatment as recommended by ferrous metal primer manufacturer.
4. Apply prime coat of ferrous metal primer immediately after pretreatment to uniform dry film thickness.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES: Inspect all surfaces to receive site metal work and report all defects which would interfere with this installation. Starting work implies acceptance of surfaces as satisfactory.

3.2 FIELD MEASUREMENTS: Take field measurements prior to preparation of shop drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary.

3.3 WORKMANSHIP

A. Verify all measurements at job. Coordinate all metalwork with adjoining work for details of attachments, fittings, etc. Do all cutting, shearing, drilling, punching, threading, tapping, etc., required for site metalwork or for attachment of adjacent work. Drill or punch holes; do not use cutting torch. Shearing and punching shall leave true lines and surfaces. Obtain Owner's Representative's review prior to site cutting or making adjustments which are not part of scheduled work. Perform necessary cutting and altering for installation and coordination with other work.

B. Conceal all fastenings where feasible. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Form joints exposed to weather to exclude water.

C. Make all permanent connections in ferrous metal surfaces using welds where at all possible; do not use bolts or screws where they can be avoided.

D. Provide all lugs, clips, anchors, miscellaneous fastenings necessary for complete assembly and installation.

E. Set all work plumb, true, rigid, neatly trimmed out, accurately fitted and free from distortions or defects detrimental to appearance or performance. Miter corners and angles of exposed moldings and frames unless otherwise noted.

F. Set railings where shown set in sleeves or cored with quick-setting non-shrink anchor cement. Size sleeves for approximately 1/4" clearance all around.

G. Where items must be incorporated or built into adjacent work, deliver to trade responsible for such work in sufficient time that progress of work is not delayed. Be responsible for proper location of such items.

H. Make provisions for erection stresses by temporary bracing; Keep work in alignment.

I. Install ornamental metal items in accordance with manufacturer's recommendations, installation instructions, and approved shop drawings.

J. Install items plumb, true and in correct relation to adjacent work, free from distortion or defects detrimental to appearance and performance.

K. Prior to securing continuous items, adjust to ensure proper matching at butt joints and correct alignment throughout their length.

L. Tolerances: Accurately align and locate components to required lines and levels to conform to following tolerances:
1. Plumb: 1/8” in 10’-0”; ¼” in 40’-0”; non-cumulative.
2. Level: 1/8” in 20’-0”; ¼” in 40’-0”; non-cumulative.
3. Location: 3/8” maximum deviation from measured theoretical location (any member and location).

3.4 WELDING:

A. Perform all welding in accordance with AWS Code D1.1. Welds shall be made only by operators experienced in performing the type of work indicated. Welds normally exposed to view in the finished work shall be uniformly made and shall be ground smooth. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter, or tramp metal.

B. Field Welding: Comply with AWS Welding Code for procedures related to field welding as related to appearance and quality of welds made and for methods used in correcting welding work. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.5 BOLTED, SCREWED AND RIVETED CONNECTIONS

A. In general, use bolts for field connections only and then only as detailed. Provide washers under all heads and nuts bearing on wood. Draw all nuts tight and nick threads of permanent connections to prevent loosening. Use beveled washers where bearing is on sloped surfaces.

B. Where screws must be used for permanent connections in ferrous metal, use flat-head-type, countersunk, with screw slots filled and finished smooth and flush.

C. Where rivets are used, they shall be machine-driven, tight, heads centered, countersunk, and finished flush and smooth.

3.6 SURFACE TREATMENT AND PROTECTIVE COATINGS

A. Cleaning: Thoroughly clean all mill scale, rust, dirt, grease and other foreign matter from ferrous metal prior to any galvanizing, hot phosphate treatment or painting. Conditions which are too severe to be removed by hand cleaning methods shall be cleaned per SSPC "Surface Preparation Specifications," "Solvent Cleaning, SSPC-SP-1"; "Power Tool Cleaning, SSPC-SP-3"; or "Brush-Off Blast Cleaning, SSPC-SP 7"; as required.

B. Exterior Ferrous Metal: Welds, burrs, and rough surfaces ground smooth and completed assembly cleaned, hot phosphate treated. Hot phosphate treatment not required on items which are not exposed in the finish work or on those items where size prohibits such treatment. Indicate on shop drawings where treatment is proposed to be omitted.

3.7 PAINTING

A. Prime Coat: After material has been properly cleaned and treated, apply two shop prime coats, each of a different color, to all surfaces except those encased in concrete or masonry. Apply all paint per manufacturer's directions. Spot paint all abrasions and field connections after assembly. Shop coats shall be dry prior to shipment to job site.

B. Finish Coats: Apply one coat per manufacturer's instructions. May be shop-applied where applicable.

3.8 GALVANIZING

A. Galvanize fabricated items after fabrication in accordance with ASTM A123-66.

B. Parts shall be made in suitable sections. First clean in a hot pickling bath to remove all scale and then rinse clean with clear water. After pickling and washing, dip parts in liquid zinc tank sufficient length of time to heat parts to zinc temperature, then remove and allow to drip and cool; straighten as required.

3.9 INSTALLATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and other miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the project site. Deliver items which are to be built into the work of other Sections in time so as not to delay the progress of the Work.

B. Protect finished surfaces against damage during construction and remove protection at time of substantial completion.

C. Railings and Guardrails:
1. Anchor posts of railings into concrete by means of pipe sleeves preset and anchored into concrete. Set sleeves in concrete with tops flush with finish surface elevations and protect sleeves from water and concrete entry. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with non-shrink non-metallic grout. Cover anchorage joint with a round stainless steel flange welded to post after placement of anchoring material.
2. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements. Mount handrails only on gypsum board assemblies reinforced to receive anchors. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Locate posts at spacing indicated, or if not indicated, at equal intervals as required by design loadings.
3. Secure handrails to wall with wall brackets and end fittings. Provide brackets of design shown, with flanges tapped for concealed anchorage and with not less than 1-1/2 in. clearance from inside face of handrail and finished wall surface. Located brackets as indicated, or if not indicated, at equal spacings as required by design loads.

D. Loose Plates: Prior to setting loose bearing and setting plates, clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates. Set on wedges or other adjustable devices. After members have been positioned and plumbed, tighten anchor bolts. do not remove wedges or shims, but if protruding, cut off flush with the edge of the plate before packing with grout. Pack grout solidly between bearing surfaces and plates to ensure no voids remain.

E. Immediately after erection, clean field welds, bolted connections, marred and abraded surfaces. Paint and touch-up paint with the specified paint system. Touch up galvanized surfaces in accordance with ASTM A780.

F. Replace items damaged in course of construction.

3.10 PROTECTION AND CLEANING

A. Remove all soil and foreign matter from finished surface and apply such protective measures as may be required to prevent damage or discoloration of any kind until acceptance of project.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all rough carpentry and structural framing as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:

1. Structural floor, wall, and roof framing.
2. Floor, wall, and roof sheathing.
3. Rough hardware, framing connectors and fasteners.
4. Treatment of wood.
5. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, wood trim, and other work requiring supporting blocking.
6. Miscellaneous wood nailers and furring strips, including roof applications, other wood framing, furring, shims or blocking as required to complete the work.

B. Related Sections:

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
2. Pertinent sections of Division 01 specifying Structural Product Requirements: Structural Product Options, Substitution procedures and limitations, transportation, handling and storage.
3. Pertinent sections of Division 03 specifying wood formwork construction and/or setting anchors in concrete.
4. Pertinent section of Division 06 specifying wood construction and materials.
5. Pertinent sections of other divisions specifying steel or concrete construction.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 23 Wood.

B. American National Standards Institute (ANSI) / American Wood Council (AWC) “NDS - National Design Specification for Wood Construction”.

C. National Institute of Standards and Technology (NIST) / Engineered Wood Association (APA) “PS 1 - Voluntary Product Standard for Structural Plywood”.

D. NIST / APA “PS 2 - Performance Standard for Wood-Based Structural-Use Panels”.

E. NIST “PS 20 - American Softwood Lumber Standard”.

F. Redwood Inspection Bureau (RIS) “Standard Specifications for Grades of California Redwood Lumber”.

G. West Coast Lumber Inspection Bureau (WCLIB) “Standard Grading Rules for West Coast Lumber No. 17”.

H. Western Wood Products Association (WWPA) “Western Lumber Grading Rules”.

I. American Wood Preservers Association (AWPA) “Book of Standards”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication. Submittals that do not meet these requirements will be returned for correction without review.

1. Substitutions for products specified require conformance to substitution requirements in Division 01.
2. Review of materials and hardware for substitution to products specified is at the additional expense of the Contractor.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Product Data:

1. Submit manufacturer's product data, specifications, and installation instructions for & location of framing connectors, wood preservative materials, application instructions, and fasteners. Include complete, accurate equivalence data when submitting alternate products to those specified. Provide samples of these items upon request.
2. Submit product data and current ICC-ES report for machine-driven nails, fasteners, and equipment, including dimensions of all fasteners, including head, shank diameter and length.

D. Shop drawings: For manufactured wood products, submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;

1. Indicate profiles, sizes, and spacing locations of structural members.
2. Cross-reference all shop drawing detail references to contract document detail references.
3. Secure all field measurements as necessary to complete this work.

E. Manufacturer's Certificate: Submit all certifications of physical and chemical properties of materials as specified below in Article titled QUALITY ASSURANCE.

1. Certify that wood products supplied for rough carpentry meet or exceed specified requirements, including specified moisture content.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17A.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Inspection of fabricators is required per CBC 1704A.2 unless fabricator is registered and approved by the building official. Wood product quality standards:

1. All wood products to comply with article REFERENCES.
2. Factory-mark each piece of lumber and sheathing with type, grade, mill, and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
3. Sheathing panels to be marked by APA (The Engineered Wood Association).

D. End-Jointed lumber shall not be used.

E. Hardware and engineered wood products shall have current ICC ES Evaluation/research reports that are equivalent to products specified.

F. Employ competent workers experienced in work of the types specified and required.

1.5 MOCK-UP

A. Construct mock-ups of machine-driven nailed sheathing panels using submitted products and demonstrating conditions indicated. Locate where directed.

B. Mock-up shall be accepted and approved by the Inspector of Record (IOR) before commencement of machine-driven nailing activity.

C. Accepted mock-up shall remain exposed for reference for the duration of machine-driven nailing activity.

D. Remove all mock-ups at the completion of the work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Delivery: Time delivery and installation of carpentry products to avoid delaying other trades whose work is dependent on or affected by this section and to comply with moisture content, protection and storage requirements.

C. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and sheathing panels to prevent deformation and provide air circulation within stacks.

1. Store materials for which a maximum moisture content is specified only in areas where relative humidity has been reduced to a level where specified moisture content can be maintained.
2. Handle and store materials above ground to prevent damage, contamination, or accumulation of dirt or foreign materials.
3. Provide special protection for horizontal sheathing panels. Deformation of panels due to moisture is not acceptable.

1.7 PROJECT/SITE CONDITIONS

A. Verify all conditions at project site affecting the work; work to field dimensions as required. Coordinate carpentry installation with size, location, and installation of service utilities.

B. Sequence rough carpentry installation activities to allow sufficient time for:

1. Review of all submittals.
2. Fabrication of mock-ups and required durations as specified.
3. Indicate submittal review, procurement, mock-up, and testing activities in the project schedule prior to the start of installation. Installation durations shall be based on hand-nailed installation methods specified.
4. Attainment of specified maximum lumber moisture content.

PART 2 - PRODUCTS

2.1 DIMENSIONED LUMBER

A. General

1. Size per industry standards for nominal sizes shown; S4S (sanded four sides).
2. Warped/twisted and excessively checked members shall not be used regardless of grade marks.
3. At the Contractor’s option, engineered lumber of equivalent size and material properties may be substituted for solid sawn lumber where material is difficult to source due to length, availability, etc. Submit proposed substitution to Engineer for review prior to purchasing materials.

B. Moisture content of framing:

1. All lumber to be maximum 19% at time of fastener installation. All lumber to be maximum 19% at time of close-in, unless noted otherwise.

2. The Owner's Testing Laboratory will test for moisture content prior to commencement of close-in.
3. The Contractor shall recognize that excessive shrinkage of lumber results from excess moisture content at the time of installation. The Contractor will compensate for use of such lumber by waiting for acceptable moisture content before close in and/or by replacing/repairing lumber that has sagged, twisted, or warped prior to close in.
4. Deviation from this specification would require structural redesign of connections and fasteners.

C. Sills/ledgers on concrete or masonry: No. 2 pressure treated Douglas Fir and as called for on the drawings.

D. Interior structural framing shall be Douglas Fir (D.F.) with grades as noted below, unless otherwise specified on the drawings. All grades are per WCLIB standard grading rules.

1. All permanently exposed (interior or protected from weather) framing shall be select structural grade with no box heart.
2. Except per 1 above, unless noted otherwise, minimum grades are:
   a. Floor/roof joists/rafters (2x) and 2x8 & larger studs & plates: D.F. No. 1
   b. 2x4 and 2x6 studs and plates: D.F. No. 1
   c. 4x and larger: D.F. No. 1
   d. Blocking: D.F. No. 1
   e. 6x8 and larger posts and beams may be SGL/CGL per below unless noted otherwise on the drawings.

E. Framing not otherwise shown or specified: Douglas Fir construction grade per WCLIB paragraphs applicable to uses and sizes required.

2.2 MANUFACTURED LUMBER

A. Laminated Veneer Lumber (LVL): for use as joists, beams, blocking, or studs when so noted on the drawings. Conform to ICC AC 47. Minimum F_b = 2,600 PSI. Minimum E=2,000,000 PSI. Acceptable products:

1. "Microllam LVL" by Trus Joist, ICC ESR-1387
2. "Redlam LVL" by RedBuilt, ICC ESR-2993
3. Approved equal

B. Laminated Strand Lumber (LSL): for use as blocking (flat or vertical) or rim joist when used with I-joist or LVL, when so noted on the drawings. Conform to ICC AC 124. Minimum F_b = 1,700 PSI. Minimum E=1,300,000 PSI. Acceptable products:

1. "Timberstrand LSL" by Trus Joist, ICC ESR-1387
2. "Redlam LSL" by Redbuilt, ICC ESR-1387
3. Approved equal

2.3 STRUCTURAL SHEATHING PANELS

A. Plywood: Structural sheathing shall conform to product standard PS-1 or PS-2. All panels shall have a minimum bond classification of “Exposure 1” and bear the trademark of the Engineered Wood Association (APA) or other qualified agency. Grades shall be “Rated Sheathing” or “Structural 1” as required on the drawings.

B. Oriented Strand Board (OSB): All structural OSB shall be grade marked by a qualified agency for conformance with Product Standard PS-2 and shall be fabricated with exterior glue. Grades shall be as required on the drawings.

2.4 TREATED WOOD:

A. Treated Lumber and Plywood: Comply with requirements of AWPA Standard U1. See Standard U1 for “Use Category” designations. Do not provide higher Use Category lumber than that specified. Maximum moisture content shall be the same as required for “dimensioned lumber” as specified above.

B. Preservative Treated Lumber

1. General
   a. Preservatives shall be waterborne. Preservative retention rate shall be as required per AWPA Standards U1 & T1. Lumber shall be Douglas Fir No. 2 (or better). Cut faces of treated wood shall be brush treated (two complete applications) prior to installation.
   b. Lumber less than 8 inches above grade and lumber less than 6 inches above exterior hard-surface flatwork shall be treated.
   c. Each piece of wood shall be stamped by the wood preservative applicator to identify its treatment and preservative retention.
2. Lumber at interior, non-weather exposed locations installed adjacent to concrete or masonry shall be Use Category UC2. Examples include sill plates & ledgers and lumber in contact with roofing, flashing, or water proofing. Borate treated lumber meeting AWPA UC2 is acceptable in this application.
3. Lumber at exterior locations, not in contact with soil/ground, shall be Use Category UC3B. Examples include Douglas Fir decking and deck framing.
4. Lumber in contact with soil/ground shall be Use Category UC4A. Examples include timber retaining walls.
5. Poles, posts, and sheathing panels shall be treated as recommended by AWPA Standard U1 per use and exposure.
6. Maximum Volatile Organic Compound (VOC) content of field-applied preservative shall meet local air quality standards and the California Green Building Code. Provide either of the following:
   a. Copper Azole (CA-B) per ICC-ES AC326.
   b. Alkaline/Copper/Quaternary (ACQ).

2.5 FASTENERS AND ACCESSORIES

A. General requirements for fasteners:

1. Fasteners shall be of adequate size, spacing, and number to resist design loads under intended use, and types shall be appropriate for the materials or conditions for which used.
2. Provide washers, pre-drilling, etc. as required for proper installation and to prevent damage to framing.
3. Fasteners shall be hot-dip galvanized (ASTM A153), mechanically galvanized (ASTM B695 class 55 minimum), stainless steel (type 303, 304, 305, or 316), silicon bronze, or copper by approved methods for the following applications:
   a. Exterior, exposed use.
   b. In contact with preservative or fire-retardant treated wood.
   c. Nails in contact with preservative treated wood containing ammonia shall be stainless steel.
4. Fasteners in moist corrosive atmosphere to be of stainless steel (type 303, 304, 305, or 316).
5. Where the retention level of ACQ or MCQ preservative is greater than 0.40 pcf, CBA-A preservative is greater than 0.41 pcf, or CA-B preservative is greater than 0.21 pcf, provide stainless steel fasteners (type 303, 304, 305, or 316).
6. All fasteners specified by manufacturer shall be installed in framing hardware, unless noted otherwise.
7. At borate treated lumber a clear zinc coating per ASTM F1941 is acceptable.

B. Nails and nailing not otherwise shown or specified:

1. Comply with requirements of governing building code.
2. For securing materials to hardened concrete or masonry provide hardened steel masonry nails or Simpson Strong-Tie “Titen” screws.
3. For framing and general woodwork: Common bright wire nails (not box nails) with centered full-round heads per ASTM F1667 including Supplement S1. 16d cement coated sinker nails may be used in lieu of common nails for framing, where noted on the drawings. Unless otherwise noted on drawings, nail sizes shall be as follows
   a. 8d Common: 0.131”ø x 2-1/2” long with 0.281”ø head.
   b. 10d Common: 0.148”ø x 3” long with 0.312”ø head.
   c. 16d Common: 0.162”ø x 3-1/2” long with 0.344”ø head.
4. Nails for sheathing panels shall be of common wire with full round heads and shall be of sufficient length to fully develop the nails.
5. Machine-driven nails of all types must comply with the requirements of this section. All proposed nails shall match diameter and penetration of specified nails.
6. Staples shall conform to length and gauges specified and shall be installed to match specified patterns and spacing.
7. Power Actuated Fasteners (PAF): Use only as approved by the Architect/Engineer; operators shall be qualified.

C. Bolts: Malleable iron washers or steel plate washers, unless otherwise shown, shall be provided under all bolt heads and nuts.

1. Machine Bolts: ASTM A307 and ANSI/ASME B18.2.1, standard semi-finished machine bolts as shown or required. Nuts shall be standard size unless noted otherwise and shall be per ASTM A563.
2. Anchor bolts or threaded rod anchors shall conform to ASTM F1554, ASTM A307, or ASTM A36. Anchor bolts shall be headed or end in two nuts tightened against one another, unless noted otherwise. Provide embedded plate washer as indicated on drawings. No upset threads allowed. No L or J bolts allowed.

D. Lag screws: Standard hex lag screws per ANSI/ASME B18.2.1.

E. Wood screws: Standard wood screws per ANSI/ASME B18.6.1.

F. Power Actuated Fasteners (PAF): Hilti X-CP72, ICC ESR-2379; Simpson PDPAWL-300 MG, ICC ESR-2138.

G. Framing hardware: Fabricated sheet metal timber framing connectors shall be manufactured from painted or galvanized G90 steel by Simpson Strong-Tie (connectors specified on drawings are per Simpson Strong Tie or approved equivalent. Connectors shall be at least 16 gauge material, (1/8 inch plate materials where welded), unless otherwise noted, punched for nailing. All heavy hardware to be fabricated from A36 steel per Division 05, Metals. All hardware intended for exterior exposed use shall be galvanized per G185 ASTM A653 or stainless steel.

1. For contact with preservative, provide minimum G185 galvanizing per ASTM A653.
2. Nails and nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. Nails to be used with framing accessories are subject to the requirements specified in this Section for fasteners and anchors.

2.6 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform testing for moisture content of all lumber at time of fastener installation.

B. The Testing Agency will submit reports as specified in Division 01.

PART 3 - EXECUTION

3.1 REQUIREMENTS FOR STRUCTURAL FRAMING

A. General

1. Refer to drawings for layouts, notes and details, provide framing as required; comply with governing building code requirements.
2. Provide framing to achieve true alignments as surfaces receiving finish materials.
3. It shall be the responsibility of the Contractor to provide and install all wood blocking, furring strips, or grounds detailed or required to provide

anchorage for all finishes, accessories, fixtures, etc. as required to complete all work. All blocking and/or backing shall be securely bolted or otherwise anchored in place.

4. Contractor shall be responsible for layout of anchor bolts, and other hardware embedded in concrete when placed by other trades.
5. Provide and install all structural framing, blocking, fasteners, brackets, clips, etc. as required to complete work specified in the Construction Documents.

B. Framing

1. Sill Plates and Ledgers:
   a. Sill plates and ledgers on concrete shall be anchored with bolts, unless noted otherwise, shall have full bearing on concrete, and shall be placed for sheathing panel nailing as indicated. All bolt nuts shall be provided with a cut plate steel washer for bearing on wood.
   b. Provide a minimum of two sill anchor bolts per sill piece with a bolt no less than 4 ½" and no more than 12" from the end of the sill. Bolts to be 5/8" diameter x 12" (18" at curb) long at 48" on centers, unless otherwise shown or noted. Provide additional anchor bolts each side of a notch or hole, as per a typical plate splice, where notch or hole is in excess of 1/3 the plate width. At shear walls, provide a plate washer 3" x 3" x 0.229" minimum between the sill and nut at anchor bolts. Plate washer to extend within ½ inch of the structural wall sheathing. Offset and/or stagger anchor bolts, or provide larger plate washer as required.
   c. Anchor bolt holes in sill plates or ledgers shall be 1/16" maximum larger than anchor bolt.
2. Stud Walls and Framing:
   a. Cut studs and posts with square ends, unless otherwise shown or noted. All posts and beams shall be "cut to bear" unless otherwise detailed.
   b. All studs in walls shall be placed with the shortest dimension parallel to the run of the wall. Bearing studs shall extend full height to be the supporting framing as shown; non-bearing studs shall extend to the supporting framing.
   c. Provide double studs on each side of all openings, unless shown or noted otherwise.
   d. All openings in stud walls and partitions shall be framed with headers across the top, as shown, with a minimum size (6" nominal depth x stud width) resting on short cripple studs, and as shown on the drawings.
   e. All stud partitions and walls shall have horizontal solid blocking not less than 2x and of the same width as the stud, fitted and nailed into the studs at mid-height of stud, for studs over 8 feet in height, except as otherwise shown or specified. This blocking shall be so spaced that there shall be no concealed air spaces greater than eight feet in any dimension.
   f. Stud partitions containing plumbing, heating or other pipes shall be so framed as to give proper clearance for piping. Plumbing,

heating and vent pipes exceeding 1-1/2" in inside diameter shall not be placed in partitions used as bearing or shear walls unless completely furred clear of the wall. No notching shall be allowed. Pipes shall be placed in the center of the plate using a neat bored hole and the plates shall be strapped on each side with 3" x 36" x 14 gauge steel punched for 10d nails 3" on center, staggered, or as shown on the drawings.

3. Top Plates
   a. Top plates shall be double, set single. Corners where stud wall or partitions meet shall be framed with studs on all surfaces and blocking to form a "rigid" corner with nailing for all corners. Double top plates shall be lapped at corners. Lap splices and nailing per the drawings.
4. Floor, Roof and Ceiling Framing
   a. Joists and beams shall be accurately aligned and the position and spacing of all joists and beams shall be as shown and be coordinated with other framing and to other trades prior to actual construction.
   b. Place all joists and beams with crown up. Cantilevered joists and beams shall be placed with the crown down.
   c. Cutting of wood girders, beams or joists for electrical and mechanical lines shall be limited to cuts and bored holes not deeper than 1/5 of the beam depth from the top and located not farther from the support than three times the beam depth and not less than the beam depth. Cuts in excess of this, or single bored holes with a diameter of more than 1" are not permitted without special provisions for framing the beams. Location of all cuts in framing shall receive the prior review of the Architect/Engineer.
   d. Provide vent holes in rafters and/or blocking as shown and/or directed by the Architect.

3.2 STRUCTURAL SHEATHING

A. General

1. Sheathing nailing shall be as required on the drawings. Do not overdrive (Do not break skin of sheathing face sheet). Over driving will be cause for rejection.
2. Form sheathing may be re-used for concealed sheathing provided the lumber at the time of re-use is approved by the Architect, meets with the framing grade requirements specified herein, is in good condition, and is thoroughly cleaned with all nails removed.
3. Pneumatic nailing devices shall be adjustable so that nail heads do not penetrate skin of sheathing. Contractor shall submit equipment and nails for review prior to use. Refer to PART 2 for other nailing requirements.

B. Roof and Floor Sheathing: Except "Panelized Roofs", lay with face grain perpendicular to roof rafters, roof trusses or floor joists. Stagger sheets. Block all unsupported sheet edges with 2x material unless noted otherwise.

C. Wall Sheathing: Lay with face grain either parallel or perpendicular to studs. Exposed bottom edges shall be sealed as recommended by manufacturer. Block all unsupported sheet edges with 2x materials unless noted otherwise.

D. Panelized Roofs: Where sheathing is set @ 8'-0 1/8" spacing, cut every fourth sheet short by 1/2" to re-align structural framing that has been specified to be spaced at even units of 2, 4 or 8 feet.

3.3 ROUGH HARDWARE

A. General: Nails, spikes, screws, fabricated sheet metal anchors, ties, hangers and any other materials shown or required for the attachment of wood to concrete and wood to steel and wood to wood shall be furnished and installed as part of this work.

B. Framing Nailing: All framing nailing shall conform to minimum requirements of the Building Code, and with details shown on the drawing.

C. Bolts, Lag Screws and Washers:

1. Bolts in wood shall be machine bolts unless otherwise noted and shall be of such length that the bearing length of the threads does not exceed ¼ of the full bearing length in the member holding the threads. Bolt holes in wood shall be 1/32" oversized. Bolt holes for sill plates may be 1/16" maximum oversize. Holes in steel shall be 1/16" oversize. See Section 3.1 for anchor bolts at sill plates and ledgers.
2. Provide square plate or malleable iron washer and nut at head where bearing is against wood; cut washer under nut where it is against steel. Washer will not be required under head of carriage bolts. Provide malleable iron washers where exposed.
3. All nuts shall be tightened when placed and retightened at completion of the job or immediately before closing with final construction.
4. Lag screws shall be screwed (not driven) into place. Drill pilot hole to 70% of shank diameter. Drill clearance hole to full shank diameter and depth of unthreaded screw length.

D. Wood Screws: Minimum penetration is 10 diameters unless noted otherwise. Where fastening hardwood timber species or where wood tends to split, provide pilot hole 70% of screw shank diameter.

E. Proprietary Fasteners and Hardware: Install per manufacturer's published installation instructions (MPII) and code approval report (e.g. ICC ESR, IAPMO ER, etc). Provide MAX quantity, size, and length of fastener at hardware (i.e. joist hangers, framing, clips, etc) unless otherwise noted per plan.

3.4 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Coordinate installation of wood decking, metal-web wood joists, glued-laminated wood construction, shop-fabricated wood trusses, and wood I- joists.

B. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members. Fasten curbs corner-to-corner and to rafters with framing connectors configured for this application.

C. Blocking:

1. Provide fire blocking at locations and spacing's as required by CBC Chapter 7. Locate other blocking, supplementary framing, backing plates and bracing to facilitate installation of finish materials, fixtures, equipment, services, accessories, and trim requiring attachment and support.
2. Solid block joists and rafters over all supports with blocking of the same size and material as the joist or rafter.

D. Furring:

1. Nominal 1 inch x 3 inch minimum, continuous and spaced at 16 inches on center, maximum.
2. Install plumb, rigid, and level. Shim where necessary to provide a true, even plane suitable to receive the finish required.
3. Attach to concrete and masonry as shown in the contract drawings.

E. Bridging: Use 2 inch solid cross bridging. Nail bottom ends of bridging only after sheathing has been nailed.

F. Install miscellaneous metal angles, bolts, and other items; secure into formwork where embedded in concrete.

G. Install accessory items not otherwise set under other sections; after completion of painting and other finishing work; in locations shown or directed by the Architect. Set items plumb, level, and secure using appropriate fastening as applicable.

3.5 FIELD APPLIED WOOD TREATMENT

A. Field treat all end cuts and holes in preservative treated materials per PART 2.

B. Apply two brush coats; or full-immersion dip not less than 15 minutes; or as required to thoroughly saturate all surfaces after cutting.

C. Air dry 2-hours minimum before installation.

3.6 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum. Provide framed substrates meeting requirements for application of finishes specified in other sections.

D. Exposed surfaces shall be free from dents and tool marks, unsanded rough or torn faces and corners, and other defects.

3.7 FIELD QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following tests and submit reports as specified in Division 01:

1. Moisture content of all lumber at time of close-in.
2. Periodic special inspection of nailing, bolting, and other fastening within the seismic-force-resisting system including shear walls, wood diaphragms, etc. per CBC Section 1705A.12.2.
3. Special inspection of high load diaphragms per CBC Section 1705A.5.1 where designated on documents.

3.8 ADJUSTING

A. Replace all defective work at Contractor's expense.

B. Replace defective or damaged work with conforming work.

C. Correct defects using means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Repair or replace framing lumber sagged, twisted or warped due to shrinkage from excessive moisture content at time of installation, or from other causes.

F. Adjust to meet specified tolerances.

G. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

H. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.

I. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.

3.9 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection, leave free of grime and dirt. Remove unused materials, tools, equipment, and debris from the premises and leave surfaces broomed clean.

B. Waste Disposal: Comply with the requirements of pertinent sections of Division 01 specifying cleaning and disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

D. Prevent sawdust and wood shavings from entering the storm drainage system.

E. Protect work from damage by subsequent operations.

END OF SECTION

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SECTION 06 17 33

WOOD I - JOISTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Include: The furnishing and installation of all wood I-joists as shown on the drawings, herein specified and necessary to complete the work.

B. Related Sections

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency Services.
2. Pertinent sections of Division 06 specifying Rough Carpentry.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 23 Wood.

B. American National Standards Institute (ANSI) / American Wood Council (AWC) “National Design Standard (NDS) for Wood Construction”.

C. International Code Council Evaluation Service (ICC-ES) “Acceptance Criteria (AC) 14 Prefabricated Wood I-Joists”.

D. American Society for Testing and Materials (ASTM) D5055 “Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists”.

1.3 SUBMITTALS

A. Submit shop drawings, furnished by the Manufacturer, showing all critical dimensions for determining fit and placement in the building and erection instructions.

1.4 QUALITY ASSURANCE

A. All wood I joists shall be manufactured in a shop approved for fabrication by the Authority Having Jurisdiction (AHJ).

B. Wood I-joists are not required to be continuously inspected during fabrication, but must carry a stamp indicating the plant of manufacture, date of manufacture, and logo of the third party independent inspection agency, conforming to AC14, and ASTM D5055.

C. Fabricators must have a minimum of three years' experience in manufacturing comparable systems and shall have a valid evaluation report issued by a qualified evaluation agency prescribed in DSA IR A-5.

D. Wood I-joists delivered shall be free from any defects in materials, and the members shall be adequate to carry the design loads for the life of the building.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Joists shall be manufactured from materials in the evaluation report and shall be of sizes and shapes shown on the contract documents.

B. Blocking construction shall be the same as I-joists, unless noted otherwise.

2.2 FABRICATION

A. Camber – None, unless noted otherwise.

B. Tolerances:

1.	Length (between outside bearing edges):	+/- 1/2 inch
2.	Depth:	+/- 3/8 inch
3.	Camber:	+/- 1/4 inch

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Wood I-joists shall be stored in a vertical position and protected from the weather. They shall be handled with care so they are not damaged. Provide bearing supports and bracings to avoid bending or overturning of I-joists, and protect I-joists from construction operations.

3.2 ERECTION AND INSTALLATION

A. Use all means necessary to coordinate the work of this section with the work of other sections to ensure proper and adequate erection of the work of this section.

B. Wood I-joists shall be installed in accordance with the approved shop drawings and installation instructions therein.

C. Temporary construction loads, which will cause member stresses beyond design limits, are not permitted.

D. Erection bracing in addition to specified bridging is to be provided to keep the I-joists straight and plumb as required to assure adequate lateral support for the individual I-joist and entire system until the sheathing material has been applied. Bridging as shown on the drawings and per Manufacturer's recommendations

shall be installed as erection of I-joists progresses and before any construction loads are placed on the I-joists.

E. Round holes may be cut in the I-joist web as indicated on the drawings. Square or rectangular holes may be cut when the diagonal dimension of the square or rectangular hole does not exceed the diameter of the maximum allowable round holes shown on the drawing. Overcut square or rectangular holes shall be treated as a hole matching the overcut. Holes exceeding maximum holes shown on the drawings are cause for rejection of the I-joist.

F. The Contractor shall give notification prior to enclosing the I-joists to provide opportunity for inspection of the installation.

END OF SECTION

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SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide finish carpentry with accessories as required for complete installation.

1. Provide wood soffit boards.
2. Provide Janitor closet metal shelves and mop holders.

B. Related Sections:

1. Section 06 40 00: Architectural woodwork; casework, countertops, and paneling.
2. Section 07 46 20: Wood siding and MiraTEC battens and trim.
3. Section 12 35 53: Manufactured metal laboratory casework.

1.2 REFERENCES

A. North American Architectural Woodwork Standards (NAAWS).

1.3 SUBMITTALS

A. Product Data: Submit literature for manufactured items.

B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, and joining details, finishes, and accessories.

C. Samples: Furnish samples of each type of finish carpentry.

D. Assurance Options: NAAWS certification and monitored compliance programs will not be required for finish carpentry.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives, sealants, and caulks, and for composite wood products formaldehyde limitations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver materials until site conditions are adequate to receive work; protect items from weather while in transit.

B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60-degrees F and maximum relative humidity of 25% to 55%.

C. Do not begin installation of finish carpentry until space is fully enclosed and mechanical systems are fully operational.

D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide finish carpentry systems specified complying with North American Architectural Woodwork Standards (NAAWS) and including accessories as required for complete installation.

B. Exterior Wood Soffits:

1. Quality: NAAWS/Premium Grade for natural finish.
2. Wood: Clear Vertical Grain Douglas Fir.
3. Texture: Surfaced.

C. Manufactured Metal Janitor Closet Storage Shelving: Provide manufactured solid metal storage shelving with accessories for complete secure installations.

1. Shelves, Supports, and Brackets: Heavy duty 20-gage minimum solid steel capable of supporting not less than 40-psf without sag or permanent damage.

a. Shop Finish: Manufacturer standard powder coat finish in color as selected by Architect.

D. Janitor Closet Mop Holders: Spring loaded anti-slip mop holders with rubber cam, with three mop holders on stainless steel.

1. Manufacturers:

a. Bobrick Washroom Equipment, Inc./Model B-223.
b. Bradley Corp./Model 9953.
c. American Specialties Inc./Model 0796A.
d. Substitutions: Refer to Section 01 25 00.

E. Anchors, Nails and Screws: Select the material, type, size, and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.

1. Exterior Soffit Fasteners: Type 304 or 316 corrosion resistant stainless steel finish ringshank nails.

F. Wood Filler: Exterior exposure, color to match wood being filled.

2.1 FABRICATION

A. Fabricate finish carpentry items in accordance with specified quality standard.

B. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.

B. Verify surfaces are ready to receive work and field measurements are as shown on shop drawings.

1. Beginning installation signifies acceptance of conditions.

C. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by applicable authorities prior to commencement of installation.

D. Inspect each piece of finish carpentry and discard damaged and defective pieces.

3.2 INSTALLATION

A. Install work consistent with specified NAAWS quality grade, plumb, level, true and straight with no distortions; shim as required, using concealed shims.

B. Secure work to blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

C. Scribe and cut for accurate fit to other finished work.

D. Install finish carpentry in single, unjointed lengths for openings and for runs less than 10'-0".

1. For longer runs, use only one piece less than 10'-0" in any straight run; provide scarf joints between members.

2. Stagger joints in adjacent members.

3. Cope at returns and miter at corners.

E. Accessories: Install accessories in accordance with manufacturer's recommendations in locations indicated or as directed by Architect.

F. Acceptable Tolerances:

1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.

2. Adjoining Surfaces of Same Material: No variation permitted.

3. Offset with Abutting Materials: Maximum 1/32".

G. Preparation for Field Finishing:

1. Sand work smooth and set exposed nails and screws.

2. Apply wood filler in exposed nail and screw indentations and leave ready to receive site-applied finishes.

3. Seal concealed and semi-concealed surfaces; brush apply only, using primer consistent with finish coats specified under Section 09 90 00 – Painting and Coating.

END OF SECTION

SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide mill fabricated architectural woodwork with accessories as required for complete finished installation including cabinetwork hardware.

1. Provide custom plastic laminate veneered wood cabinetwork and countertops.
2. Provide wood board paneling for walls and ceilings.

B. Related Sections:
1. Section 06 20 00: Finish carpentry; wood soffit, metal shelving, and mop holders.
2. Section 07 46 20: Wood siding.
3. Section 12 35 53: Laboratory Casework System and Accessories.

1.2 REFERENCES

A. North American Architectural Woodwork Standards, (NAAWS).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature for manufactured items.

B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, joining details, finishes, and accessories.

1. Certification: Provide Woodwork Institute Certified Compliance Label on shop drawings.

C. Samples: Furnish samples of each exposed finish.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives, sealants, and caulks, for composite wood products formaldehyde limitations, and for paints and coatings.

B. Fabricator Qualifications: Member of Sponsor of North American Architectural Woodwork Standards with minimum five years successful experience fabricating woodwork like that required for Project.

C. Standards: Perform architectural woodwork in accordance with North American Architectural Woodwork Standards (NAAWS).

1. Certified Compliance Program (CCP): Comply with Woodwork Institute "Certified Compliance Program (CCP) as defined in NAAWS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver architectural woodwork until site conditions are adequate to receive work; protect items from weather while in transit.

1. Allow architectural woodwork shop finish to completely dry prior to delivery to site; allow materials to off-gas volatile organic compound (VOC) emissions off site.

B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60-degrees F and maximum relative humidity of 25% to 55%.

C. Do not begin installation of architectural woodwork until space is fully enclosed and mechanical systems are fully operational.

1. Maintain installation areas at 70 degrees F and 50% to 55% relative humidity.

D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide mill fabricated architectural woodwork with accessories as required for complete finished installation including cabinetwork hardware.

B. Plastic Laminate Finished Casework and Countertops:

1. Quality: NAAWS/Custom Grade frameless, flush overlay, unless otherwise indicated.

a. Special: Provide each single length section of casework in largest such sections as access and openings allow.

1) Multiple self-supporting units fastened together to form larger unit allowed only where access and openings do not allow single lengths.

2. Plastic Laminates:

a. Types: NEMA LD-3.1 high pressure laminates.

1) Horizontal Surfaces: General Purpose Type, nominal 0.050".
2) Vertical Surfaces: Vertical Surface Type, nominal 0.032".
3) Unexposed Surfaces: Balanced with 0.030" melamine backing sheet.

b. Manufacturers:

1) Formica Corp.
2) Wilsonart, Wilsonart Engineered Surfaces.
3) Nevamar Corp.
4) Abet Laminati Co.
5) Substitutions: Refer to Section 01 25 00.

c. Colors: As selected by Architect from manufacturer's full range of available colors and patterns, excluding metallics.

3. Wood Core: Plywood or medium density fiberboard (MDF) or particleboard, with no added formaldehyde and free of toxic materials.

C. Casework Hardware: Provide casework hardware items as required for complete installation as indicated; provide types as listed in North American Architectural Woodwork Standards for casework, but no less than following types.

1. Adjustable Shelf Standards and Supports: Match BHMA A156.9 B04073 adjustable standards and B04083 closed shelf rest brackets for mortis mounting; flush mounted in cabinet.

2. Cabinet Hinges: BHMA A156.9 B01602 or B01603 frameless European concealed type, minimum 160 degree opening, with spring closer.

3. Cabinet Pulls: As indicated, as directed by Architect where not indicated.

4. Drawer Slides: Full extension, rail mounted type, minimum 100 lb. capacity with ball-bearing rollers; self-closing.

5. Cabinet Locks: Pin and tumbler slide bolt lock with five pin tumblers as approved by Architect, two keys each.

D. Transparent/Stained Finished Interior Wood Board Paneling for Walls and Ceilings:

1. Quality: NAAWS/Premium Grade, type as indicated.

2. Wood: Nominal 1x8 Clear Vertical Grain Douglas Fir with V-Groove Edge.

E. Anchors, Nails and Screws: Select material, type, size, and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.

F. Wood Filler: Color to match wood being filled.

2.2 FABRICATION

A. General: Fabricate architectural woodwork in accordance with specified North American Architectural Woodwork Standards.

B. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline; slightly bevel arises.

1. Locate butt joints at least 2'-0" from cutouts.

2. Cap exposed edges with plastic laminate of same finish and pattern.

3. Apply laminate backing sheet to reverse side of laminate surfaces.

4. Provide cutouts for inserts, fixtures, and fittings; verify locations from on-site dimensions.

5. Prime paint contact surfaces of cutouts.

6. Plastic Laminate Countertops: Square butt joints and self edging; applied plastic or metal edging not permitted.

    a. Splashes as indicated or as directed by Architect where not otherwise indicated.

C. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.

D. Assemble woodwork in shop in sizes easily handled and to ensure passage through building openings.

2.3 FINISHES

A. Transparent/Stained Finished Woodwork: Finish architectural woodwork in shop unless otherwise indicated.

1. Wood: As specified and indicated on Drawings; match Architect samples.

2. Sand work smooth; seal, stain and varnish concealed and semi-concealed surfaces of transparent/stained finished woodwork; brush apply.

3. Transparent/Stained Finish: NAAWS/Premium Grade water-based polyurethane finish producing a dull rubbed effect, as approved by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.

3.2 INSTALLATION

A. Install work consistent with North American Architectural Woodwork Standards specified quality grade, plumb, level, true and straight with no distortions.

1. Shim as required, using concealed shims.

B. Ensure mechanical and electrical items affecting architectural woodwork are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

C. Secure work to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation except where otherwise required by NAAWS.

D. Scribe and cut for accurate fit to other finished work.

E. Install architectural woodwork under supervision of factory-trained mechanics.

F. Attach architectural woodwork securely in place with uniform joints providing for thermal and building movements.

G. Paneling: Provide fire-treated wood stops eight feet on center at paneling where required by applicable codes when paneling is not direct applied to substrate.

H. Acceptable Tolerances:

1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.

2. Adjoining Surfaces of Same Material: No variation permitted.

3. Offset with Abutting Materials: Maximum 1/32".

END OF SECTION

SECTION 07 13 00

SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide self-adhesive sheet membrane waterproofing system at foundations including sealing joints and protrusions through waterproofing, with drainage composite covering, and accessories for complete watertight installation.

B. Related Sections:

1. Section 07 25 00: Weather barrier/underlayment including sheet membranes.
2. Section 07 26 00: Below grade vapor retarder.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature for waterproofing system and protection board.

B. Shop Drawings: Indicate flashings, joints, sealing at openings, projections, and waterproofing of holes, slots, and sleeves.

C. Certificates: Submit manufacturer's representative's certification work has been installed in accordance with manufacturer's recommendations.

1.3 QUALITY ASSURANCE

A. Qualification of Installers: Minimum five years successful experience in projects of similar scope.

1.4 SITE CONDITIONS

A. Do not apply waterproofing during inclement weather or when air temperature is below 40 degrees F, except where specifically authorized by manufacturer's representative for specific materials.

B. Do not apply waterproofing to damp, dirty, dusty, or otherwise unsuitable surfaces.

1. Allow concrete surfaces to cure minimum 28 days.

1.5 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist water penetration except where failure is result of structural failure of building. Repair system and pay for or replace damaged materials and surfaces.

1. Hairline cracking due to temperature or shrinkage is not structural failure.

2. Period: Two years.

B. Manufacturer’s Warranty: Submit manufacturer’s warranty including special manufacturer services as required for manufacturer’s warranty.

1. Period: 10 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner’s rights under implied and expressed warranties regardless of wording of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. GCP Applied Technologies (Grace) /Bituthene 3000 or 4000 Waterproofing System.

B. Carlisle Coatings and Waterproofing/CCW Miradri Waterproofing.

C. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide sheet membrane waterproofing system including sealing joints and protrusions through waterproofing, protective covering, and accessories.

B. Regulatory Requirements: Provide materials conforming to applicable air quality management district limitations on volatile organic compound (VOC) emissions.

C. Waterproofing System: System consisting of sheet membrane of rubberized asphalt and polyethylene film, total thickness approximately 60 mil, and fluid applied rubberized asphalt for sealing system.

1. Low Temperature Applications: Where temperatures are between 25 degrees F and 40 degrees F, use manufacturer's special membrane and primer for low temperature applications.

D. Primer: Manufacturer's recommended primer of applications involved; primer is required for waterproofing applications.

E. Crack and Expansion Joint Sealants: Types as recommended by waterproofing system manufacturer, compatible with waterproofing system.

F. Drainage Composite: Formed plastic with filter fabric designed to allow penetration and drainage of water while retaining silts, soils, and similar particulate matter; type recommended by manufacturer for application.

1. Manufacturers:

a. Waterproofing manufacturer.
b. Grace/Hydroduct Drainage Composite.
c. Carlisle/CCW MiraDRAIN.
d. Substitutions: Refer to Section 01 25 00.

G. Accessories: Provide as indicated; as recommended by system manufacturer and compatible with waterproofing system, and as required for watertight installation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare surfaces in accordance with manufacturer's recommendations.

B. Ensure sleeves, curbs and projections which pass through waterproofing are properly and rigidly installed.

C. Ensure surfaces are free of cracks, depressions, waves, and projections which may be detrimental to proper installation of waterproofing.

1. Repair surfaces as required by manufacturer's representative.

D. Seal cracks and expansion joints with recommended backup material and sealant; ensure proper depth-width ratio as recommended by sealant manufacturer.

E. Ensure expansion joints are sharply formed, free of broken edges and loose aggregates.

F. Clean surfaces of dust, dirt, and foreign matter detrimental to proper installation of waterproofing.

G. Prime surfaces to receive waterproofing in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Apply waterproofing in accordance with manufacturer's recommendations and installation instructions as required for watertight installation.

1. Seal joints and items projecting through waterproofing.

B. Seam Overlap: Minimum 2-1/2".

1. Stagger end laps.

C. Reinforce corners with double applications of waterproofing unless otherwise specifically recommended by manufacturer's representative.

D. Allow extra materials at joints with anticipated movement to permit movement without stressing waterproofing.

E. Roll waterproofing membrane smooth, firmly, and completely to surfaces indicated, with no fish-mouths or bunches of material.

F. Inspect and repair waterproofing in accordance with manufacturer's instructions prior to application of protection board and backfill.

G. As soon as possible after installation and inspection apply protection boards and drainage composites in accordance with manufacturer's recommendations.

1. Neatly fit around pipes and penetrations.

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Services: Manufacturer's representative shall inspect work of Project on regular basis and provide certification waterproofing has been installed in accordance with manufacturer's recommendations.

1. Provide unobstructed access to waterproofing work.

2. Correct defects and irregularities as advised by manufacturer's representative.

END OF SECTION

SECTION 07 21 00

THERMAL INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide insulation and accessories as required for complete installation.

1. Provide thermal batt insulation.
2. Provide spray-foam insulation.
3. Provide continuous extruded polystyrene thermal insulation.
4. Provide nailable roof insulation panels.

B. Related Work:

1. Section 07 46 50: Insulation integral with GFRC façade panels.
2. Section 07 53 00: Insulation integral with elastomeric TPO membrane roofing.
3. Section 07 84 00: Firestopping.
4. Section 09 21 00: Acoustical insulation concealed in gypsum board systems.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of insulation.

1. Submit Underwriter's Laboratory approval numbers for required fire ratings. Approvals of other laboratories contingent upon acceptance of applicable authorities.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to energy efficiency.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide thermal insulation with accessories.

B. Thermal Batt Insulation: Preformed slag mineral or glass fiber with thermosetting resin binders, conforming to ASTM C665; formaldehyde-free.

1. Manufacturers:

a. Johns Manville/Thermal-Shield Insulation.
b. Owens-Corning Fiberglas Corp./Fiberglas Insulation.
c. CertainTeed/Thermafiber Insulation.
d. Substitutions: Refer to Section 01 25 00.

2. R-Value: Comply with Project Title 24 Report.

3. Flame Spread/Smoke Developed Rating: Maximum 25/450, ASTM E84.

4. Vapor Retarder: Type I, no vapor retarder.

5. Combustibility: Pass ASTM E136.

6. With facing meeting noncombustible or limited-combustible criteria stapled to and with facing covering bottom of joists at areas with suspended ceiling below – Owens Corning Flame Spread 25 FIBERGLAS® Insulation or equivalent product from other manufacturers.

C. Spray-Foam Insulation: Provide on-site foaming type closed cell insulation as required to fill cavity.

1. Manufacturers:

a. Johns Manville/Corbond III Closed Cell Insulation.
b. CertainTeed/CertaSpray Closed Cell Insulation.
c. BASF/Spraytite Closed Cell Insulation.
d. Substitutions: Refer to Section 01 25 00.

2. R-Value/Thickness: As indicated.

D. Polystyrene Insulation (Continuous Exterior Walls): ASTM C578, extruded polystyrene insulation with skin surface; square edges; "K" factor of 0.20.

1. Manufacturers:

a. Dow/Styrofoam or Formular.
b. Pactiv Building Products/GreenGuard Insulation Board.
c. Owens Corning/Foamular.
d. Substitutions: Refer to Section 01 25 00.

2. R-Value: Minimum R-5 at 1” thickness.

E. Nailable Roof Insulation Panels: ASTM C1289, Type V, polyisocanurate insulation board bonded to minimum 7/16” APA/TECO rated OSB or minimum 19/32” CDX plywood on the top face.

1. Manufacturers:

a. Atlas Roofing Corporation.
b. GAF Materials Corporation.
c. Equivalent products of other manufacturers.

2. R-Value: Minimum LTTR-6.3 at 1.5” thickness.

F. Accessories: Furnish as indicated and as recommended by insulation manufacturer for insulation types, substrates, and conditions involved.

1. Fasteners and Attachment Devices: Comply with insulation manufacturer recommendations for attachment of insulation.

2. Fasteners to withstand loads specified for system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.

B. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

3.2 INSTALLATION

A. General: Install insulation in accordance with manufacturer's instructions and applicable code requirements. Cut and trim insulation neatly, to fit spaces.

1. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within insulation plane; leave no gaps or voids; maintain integrity of thermal barrier.

B. Batt Insulation: Friction fit batt insulation in place; use tape or penetration supports as necessary to assure permanent installation.

1. Taping: Tape tears in integral vapor retarder.

2. Penetration Supports: Cut or bend pins in locations accessible to maintenance personnel, to eliminate potential hazards from exposed pinpoints.

C. Spray-Foam Insulation: Apply in accordance with manufacturer's instructions to achieve specified thermal resistance and uniform coverage and density.

1. Assure clips, hangers, supports, sleeves, and other items installed within insulation space are in place before applying insulation.

2. Remove excess, overspray, droppings, and debris.

D. Continuous Insulation Installation: Comply with manufacturer recommendations and installation instructions for continuous insulation for use in systems indicated.

END OF SECTION

SSECTION 07 25 00

WEATHER-RESISTIVE BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide weather-resistive barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories as required for complete watertight installation.

1. Wall Underlayment: Provide vapor permeable self-adhering sheet underlayment and flashing for exterior wall applications, with related concealed metal flashings and accessories as required for complete airtight and watertight installation.

2. Sloped Roofing Underlay: Provide high-temperature self-adhering sheet membrane underlayment at sloped roofing systems, with accessories as required for complete watertight installation.

3. Flashings and Sheet Metal Underlay: Provide high-temperature self-adhering sheet membrane underlayment at flashings and sheet metal, with accessories as required for complete watertight installation.

4. Penetrations: Provide flashing for around penetrations through underlayment including but not limited to windows, doors, louvers, vents, piping, and conduit, with accessories as required for complete watertight installation.

a. System: By same manufacturer as underlayment; system may be either fluid-applied or sheet membrane as recommended by underlayment manufacturer.

B. Related Sections:

1. Section 07 13 00: Sheet waterproofing.
2. Section 07 26 00: Below grade vapor retarder.
3. Section 07 41 15: Manufactured standing seam roofing.
4. Section 07 60 00: Exposed metal flashing.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Weather Barriers: Provide weather-resistive barrier/underlayment systems which, with other building components, comply with applicable code requirements for air barriers and water barriers.

1. Air Barriers: Air barriers shall be as defined by applicable Energy Code requirements and shall include standard exterior wall components and air seal joint sealants specified in Section 07 90 00 – Joint Sealants.

2. Water Barriers: Water barriers shall be as defined by applicable Building Code requirements and shall include vapor permeable systems with or without rainscreen barriers intended to extend amount of water drained to exterior.

3. Penetrations: Intent of sealing window openings, door openings, and other penetrations through underlayment is to ensure water cannot move from exterior surface past water barriers and into building.

B. Pre-Installation Meeting: Convene one week prior to commencing work; require attendance of parties directly affecting underlayment.

1. Review procedures and coordination required with related work.

C. Coordination: Coordinate air and water barrier systems with adjacent materials and assemblies to ensure material compatibility, sequencing, and air and watertight installation is achieved especially related to terminations, transitions, and penetrations.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of underlayment.

B. Samples: Furnish samples of each material.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives and fluid-applied materials (coatings).

1.5 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide weather-resistive barrier/underlayment air and water barrier systems for siding, sloped roofing, flashing and sheet metal, and penetrations with accessories.

B. Regulatory Requirements: Provide materials conforming to applicable air quality management district limitations on volatile organic compound (VOC) emissions.

C. Wall Underlay: Provide vapor permeable water barrier type self-adhering sheet underlayment system for complete watertight installation as recommended by manufacturer for substrates and applications indicated.

1. Manufacturers:

    a. GCP Applied Technologies (Grace)/Perm-A-Barrier VPS Self-Adhering Sheet.
    b. Henry Company/Blueskin VP160 Self-Adhered Air and Weather Barrier.
    c. Carlisle Corp./CCW 705 VP.
    d. Substitutions: Refer to Section 01 25 00.

D. High Temp Metal Roofing and Sheet Metal and Flashing Underlay: High-temperature self-adhering sheet membrane with primers and seam sealers as required for complete watertight installation; suitable for substrates and for applications indicated.

1. Manufacturers:

    a. GCP Applied Technologies (Grace)/Ultra.
    b. Henry Company/Blueskin PE200HT.
    c. Carlisle Corp./CCW WIP 300HT High Temp Roof Shield.
    d. Substitutions: Refer to Section 01 25 00.

E. Penetrations: Provide flashing at penetrations with accessories for complete watertight installation; type as recommended by manufacturer for substrate and for applications indicated. System to be compatible with adjacent underlayment materials.

1. Manufacturers: Provide penetration flashing by underlayment manufacturer.

2. Provide specific membrane types as recommended by system manufacturers for each type of application.

F. Concealed Metal Flashings Integral with Underlay: Minimum 26 gage thick steel with minimum 0.90 oz/sf galvanized coating; ASTM A653.

1. Fasteners: Standard round wire type of hot dipped galvanized steel; minimum 19/64" head diameter and 0.104" shank diameter; minimum 7/8" long.

G. Bituminous Paint: Acid and alkali resistant type; black color.

H. Accessories: Provide as recommended by underlayment manufacturers for specific applications.

1. Concealed Sealant at Metal Flashing: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.

2.2 FLASHING FABRICATION

A. Fabricate metal flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".

B. Form flashings to drain water to exterior at roofing and siding construction for penetrations, sill, and header flashings.

C. Form sections square, true and accurate to size, in maximum possible lengths and free from distortion and other defects detrimental to appearance or performance.

D. Hem exposed edges of metal flashings minimum 1/4" on underside.

E. Apply bituminous paint on concealed surfaces of metal flashings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with underlayment manufacturer recommendations for examination and preparation of substrates to receive underlayment.

B. Install underlayment over surfaces that are dry, free of ridges, warps and voids that could damage underlayment.

C. Coordinate installation with installation of components and items projecting through underlayment.

3.2 FLASHINGS INSTALLATION

A. Install flashings as recommended by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Sheet Metal Manual".

B. Weatherlap joints minimum 2", seal with plastic cement, and secure in place.

C. Fastenings: Concealed in completed installation.

3.3 UNDERLAYMENT INSTALLATION

A. Install weather-resistive barrier in accordance with installation instructions and recommendations of each manufacturer and of manufacturers of products to cover weather-resistive barrier; comply with applicable code requirements.

1. Wall Underlay: Provide one-layer sheet membrane underlayment.

2. Sloped Roofing: Provide one-layer sheet membrane underlayment.

3. Flashing and Sheet Metal: Provide one-layer sheet membrane underlayment.

4. Penetrations: Apply penetration flashing extending minimum 18" from penetrations, including windows and doors; start at bottom of penetration and weatherlap.

    a. Apply over metal flashing to direct water to exterior.

5. Weatherlap joints as recommended by system manufacturer.

6. Secure underlayment in place, stagger joints between sheet membrane layers; lap ends minimum 6"; stagger end joints.

B. Sheet Membranes: Weatherlap items projecting through sheet membrane underlayment and seal with sealer recommended by sheet membrane underlayment manufacturer.

END OF SECTION

SECTION 07 26 00

BELOW-GRADE VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature.

1.3 SITE CONDITIONS

A. Do not apply vapor retarder during inclement weather or when air temperature is below 40 degrees F.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Fortifiber Corp./Ultra 15.

B. Raven Industries, Inc./Vapor Block # VB 15 (15 mil Blue).

C. Stego Industries, Inc./Stego Wrap (15 mil).

D. W.R. Meadows/Perminator (15 mils).

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description Includes: Provide vapor retarder system for below grade and slab-on-grade concrete, including sealing joints and protrusions through vapor retarder.

B. Vapor Retarder: ASTM E1745, Class A vapor retarder consisting of 15 mil polyolefin film.

1. Permeance: Maximum 0.025 perms, ASTM F1249 and E154 tests.

2. Resistance to Puncture: Minimum 2200 grams, ASTM D1709, Method B.

3. Tear Resistance: Minimum 8.74 lbs., ASTM D1004.

4. Tensile Strength: Minimum 35 lbs/in., ASTM E154, Section 9, Method D-882, in both directions.

C. Joint Sealer: Pressure sensitive tape as recommended by vapor retarder manufacturer and providing comparable permeance to vapor retarder.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure sleeves, curbs and projections that penetrate vapor retarder are properly and rigidly installed.

B. Ensure substrate is free of projections and irregularities that may be detrimental to proper installation of vapor retarder.

3.2 INSTALLATION

A. Apply vapor retarder in accordance with manufacturer's recommendations and installation instructions and in accordance with ASTM E1643; comply with most restrictive where conflicts occur.

1. Seal perimeters and items projecting through vapor retarder with pressure sensitive tape.

B. Seams: Minimum 12" overlap, sealed with pressure sensitive tape for vapor tight seal.

C. Lay vapor retarder membrane smooth with no fish-mouths or bunches of material.

D. Inspect and repair vapor retarder prior to application of concrete slab; tape tears and repair damage.

END OF SECTION

SECTION 07 41 15

MANUFACTURED STANDING SEAM ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide factory finished manufactured metal standing seam type roofing including integral metal flashings and sealants, and accessories as required for complete weather-tight installation.

B. Related Work:

1. Section 07 21 00: Thermal insulation.
2. Section 07 25 00: Weather barrier/underlayment.
3. Section 07 60 00: Flashing and sheet metal not integral with roofing.

1.2 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Convene pre-construction conference one week prior to metal roofing work to coordinate roofing with other trades; require attendance of parties directly affecting metal roofing work.

1. Review installation and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for prefabricated components, and recommendations for cleaning and protection.

B. Shop Drawings: Indicate dimensioning, panel layout, general construction details including closures, flashings, locations of and types of sealants, and anchorage.

C. Samples: Furnish finished preformed metal roofing and each type of exposed metal flashing.

1.5 QUALITY ASSURANCE

A. Qualification of Installer: Company with minimum five years successful experience in work of comparable scope.

B. Mock-Up: Provide 200 square foot mock-up of metal roofing construction, including integral fascia, gutter, and trim matching metal roofing, at location approved by Architect; approved mock-up may be incorporated into Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide protective covering on finished flashing materials to protect them through installation.

1.7 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Three years.

B. Manufacturer’s Warranty: Submit manufacturer’s warranty including special manufacturer services as required for manufacturer’s warranty.

1. Period: 20 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner’s rights under implied and expressed warranties regardless of wording of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Metal Sales Manufacturing Corp.

B. Approved equal.

2.2 MATERIALS

A. System Description Includes: Provide factory finished manufactured metal standing seam type roofing including integral metal flashings and sealants, and accessories.

B. Regulatory Requirements: Comply with California Building Standards Code requirements for metal roofing systems.

1. Cool Roof System: Comply with California Building Standards Code requirements for “Cool Roof” system including three-year aged solar reflectance value requirements.

a. Label: System to have Cool Roof Rating Council (CRRC) label.

C. Design Criteria: Design system to provide movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100-year seasonal temperature ranges.

1. Design system to accommodate tolerances of structure, provided irregularities do not exceed industry recognized standards and clearances are maintained.

2. Provide for positive drainage of water entering or occurring within preformed metal roofing system.

D. Standing Seam Metal Roofing System: Preformed metal roofing system complete with anchoring assembly and accessory components.

1. Basis of Design: Metal Sales Magna-Loc (180-degree seam) including integral fascial, gutters, and trim.

2. Type: Manufacturer's standard standing seam system specified with pans on centers indicated.

3. Sheet Metal: Minimum 24-gage galvanized steel, minimum G90 galvanized coating, ASTM A924 and A653.

4. Finish: Manufacturer's standard Galvalume (41).

E. Sealants and Gaskets: Manufacturer's standard type suitable for use in conjunction with installation of metal roofing.

1. Non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior applications.

2. Color of exposed sealants and gaskets to match roofing.

F. Fasteners: Manufacturer's standard hot dip galvanized fasteners with not less than G90 galvanized coating.

1. Finish exposed fasteners to match roofing.

G. Underlayment: Specified in Section 07 25 00 – Weather Barrier/Underlayment.

2.3 FABRICATION

A. Internal and External Corners: Same materials, material thickness and finish as roofing, profile to suit system, brake formed, shop-cut and factory mitered to required angles.

B. Mitered internal corners shall be backed with minimum 22-gage galvanized steel sheet stock to maintain continuity of profile.

C. Expansion Joints: Provide concealed metal expansion control throughout roofing system.

D. Integral Sheet Metal, Fascia, Flashings, Gutters, Closures and Other Components: Brake formed to required profiles; conform to SMACNA Manual.

1. Conform to requirements specified in Section 07 60 00 - Flashing and Sheet Metal

E. Provide for positive drainage to exterior, any water entering or occurring within metal roofing systems.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate is free of elements that could be harmful to system.

B. Beginning of work signifies acceptance of conditions.

C. Take special care not to damage underlayment beyond that required to secure system to structure.

3.2 INSTALLATION

A. Install manufactured metal standing seam roofing in accordance with manufacturer's recommendations, installation instructions, and approved shop drawings.

B. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Comply with installation requirements specified in Section 07 60 00 - Flashing and Sheet Metal.

C. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.

D. Protect metal surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow protective coating to dry prior to installing members.

E. Permanently fasten roofing system to structural supports, properly aligned, leveled and plumb.

1. Maximum 1/16" offset from true alignment between adjacent members butting or in line.

2. Maximum 1/4" variation from plane or location indicated on Drawings.

F. Locate end laps over supports; end lap panels minimum 2"; ensure side-laps are over firm bearing.

G. Provide expansion joints at regular basis, concealed within system.

H. Use concealed fasteners except where specifically approved by Architect.

I. Install sealants and gaskets where required to prevent direct weather penetration.

J. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.

K. Remove protective coating when no longer required to protect roofing and flashing from construction.

END OF SECTION

SECTION 07 46 20

WOOD SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide wood siding with accessories as required for complete weathertight installation.

1. Provide wood board and batten type siding using plywood boards and wood battens and trim.

B. Related Sections:

1. Section 06 20 00: Exterior wood soffit boards.
2. Section 07 25 00: Weather barrier/underlayment.

1.2 REFERENCES

A. Lumber Standard: PS-20, American Softwood Lumber Standard.

B. Plywood Standard: PS-1, Construction, and Industrial Plywood.

C. General Grading Rules: Western Wood Products Association (WWPA) grading rules and inspection.

D. North American Architectural Woodwork Standards, (NAAWS).

1.3 SUBMITTALS

A. Shop Drawings: Clearly indicate general construction, configurations, jointing methods, and locations, fastening methods and locations and installation details.

1. Indicate where exposed fasteners will be required.

B. Samples: Provide samples of each type of wood siding and soffit.

C. Wood Product Certification: Furnish certification indicating wood products are from “well-managed” forests.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for composite wood products formaldehyde limitations.

B. Qualification of Installer: Firm with not less than five years successful experience with similar size and type projects.

1.5 PRODUCT HANDLING

A. Store siding materials to prevent warping and weather damage; elevate on level blocking; covering shall permit adequate ventilation.

B. Acclimatize siding to site by storing outside on job site minimum five days prior to installation.

1.6 WARRANTY

A. Extended Correction Period: Extend correction period to two years.

1. Repair or replace defective siding that fails through corrosion or finish damage because of manufacturing defects.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description Provide both board siding and plywood siding, including plywood soffits with accessories.

B. Design Criteria: Custom pieces shall conform to Architectural Woodwork Standards (AWS).

A. Plywood: American Plywood Association (APA).

1. Siding: Minimum nominal 5/8" exterior grade plywood unless otherwise indicated.
2. Face: Western Red Cedar, for transparent finish.
3. Texture and Finish: Rough Sawn.
4. Grade: WCLIB Grade "Clear VG Heart". vertical grain.
5. Type: Shiplap, square channel board, horizontal siding.

B. Batten and Trim Pieces: 5/4 Western Red Cedar, Grade A or Better, rough sawn face, kiln dried.

1. Fabrication: Comply with North American Architectural Woodwork Standards (NAAWS) requirements for not less than Custom Grade exterior trim.

C. Nails: Corrosion resistant nonmagnetic Type 304 or 316 stainless-steel siding nails; minimum 10d where over sheathing.

D. Accessories: Provide as required for complete finished siding installation.

1. Provide inside and outside corners as indicated on Drawings, as directed by Architect where not otherwise indicated.

2. Provide other components required for complete, finished siding; match siding unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install wood siding and composite battens and trim over surfaces which are dry, free of ridges, warps and voids.

B. Coordinate installation of siding with installation of items projecting through; ensure openings are properly sized and located prior to siding installation.

C. Underlayment: Take special care not to damage underlayment beyond that required to secure wood siding to structure.

3.2 INSTALLATION

A. Install siding and composite battens and trim in accordance with manufacturer's instructions, North American Architectural Woodwork Standards (NAAWS), and as required to match patterns as indicated on Drawings.

B. Avoid face nailing on siding, conceal fasteners when possible.

1. Power Driven Staples: Not permitted.

C. Plywood Siding: Install panels with maximum 1/16" space between adjacent panels unless otherwise recommended by plywood siding manufacturer or American Plywood Association (APA).

D. Battens, Trim, and Custom Pieces: Install as required for complete, weathertight system; comply with North American Architectural Woodwork Standards (NAAWS).

1. Seal cut ends with primer approved by manufacturer.

3.3 CLEANING

A. Clean marks, debris, and dirt from exposed surfaces of mineral-fiber units using manufacturer recommended cleaning materials and procedures which do not stain nor damage panels or fasteners.

END OF SECTION

SECTION 07 46 50

GFRC FAÇADE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide architectural quality precast GFRC façade system with anchors, connecting, supporting, and hoisting devices, integral foam insulation, and accessories as required for complete installation.

B. Related Sections:

1. Section 07 90 00: Joint sealants.

1.2 REFERENCES

A. Prestressed Concrete Institute (PCI) MNL 117: Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

B. Prestressed Concrete Institute (PCI) MNL-128: Recommended Practice for Glass Fiber Reinforced Concrete Panels.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Design/Build: Provide engineering for GFRC façade system to ensure compliance with applicable codes and Contract Documents.

B. Coordination: Coordinate methods for making junctures with adjacent surfaces watertight with Section 07 90 00 – Joint Sealants.

C. Testing: Provide testing by independent firm appointed and paid for by manufacturer; submit name of firm to Architect for review.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s literature and test results.

B. Shop Drawings: Indicate unit locations, unit identification marks, fabrication details, connection details, pertinent dimensions, and erection support points.

1. Unit Identification Marks: Locate on manufactured units in areas concealed after construction is complete.

2. Do not proceed with fabrication until shop drawings have been accepted.

3. Prepare shop drawings under seal of California licensed structural engineer.

C. Samples: Furnish samples of each width of façade units with surface representative of finish required, for each finish required.

D. Test Results: Submit source quality control test results.

E. Manufacturer Certification: Submit certification by precast manufacturer indicating architectural precast concrete complies with Contract Documents and applicable codes.

F. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating calculations have been made and work complies with Contract Documents and code requirements.

1. Calculations: Submit copies of engineering calculations if requested by Architect or by applicable authorities.

1.5 QUALITY ASSURANCE

A. Qualification of Manufacturer: Company specializing in architectural precast products normally associated with high quality finishes, and with minimum five years experience in work of comparable scope.

B. Qualification of Installer: Manufacturer or firm with minimum five years experience in work of comparable scope and approved by manufacturer.

C. Mock-Up: Construct and erect at job six full size GFRC units, representative of proposed finish, size, shape, and anchorage.

1. Mock-up may be used as part of work if conforming to specified requirements and accepted by Architect.

2. Accepted mock-up units establish minimum standard of quality and workmanship for GFRC façade work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handle units in positions consistent with their shape and design. Lift and support only from support points indicated on shop drawings.

B. Embedded Lifting and Handling Devices: Capable of supporting units in positions anticipated during manufacture, storage, transportation, and erection.

C. Block and laterally brace precast units during transport and while stored on-site; provide lateral bracing sufficient to prevent bowing and warping.

1. Blocking and Bracing: Clean, non-staining, and designed to allow uniform curing of exposed surfaces.

D. Protect edges of units to prevent staining, chipping, or spalling. Damaged panels will be rejected.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Reider (www.rieder.cc)/OKO Skin Stripes.

B. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide architectural quality GFRC façade system with anchors, connecting, supporting, and hoisting devices, and accessories.

B. Regulatory Requirements:

1. Design units to support required loads as indicated in California Building Code.

C. Performance Criteria:

1. Design GFRC units and component connections to withstand weight of, and forces subjected to, GFRC units.

2. Allow for foundation settlement and building movement.

3. Provide adjustment connections to accommodate structural tolerances.

4. Design system to accommodate movement in structure and between cladding elements and structure without permanent distortion, component damage, joint connection wracking, or seal breakage.

D. General Materials Requirements: Conform to ACI 544 recommendations.

1. Manufacture GFRC units to ensure similarity of dimension and finish throughout.

2. Cement: ASTM C150, Type I unless otherwise approved in advance, use only one brand and type of cement throughout Project.

a. Color: White color as required to consistently match approved sample.

3. Glass Fibers: Alkali resistant (AR) glass fibers produced specifically for use in glass fiber reinforced concrete work; chopped strand type; 1-1/2" to 2" lengths.

a. Conform to PCI recommendations.

4. Aggregates:

a. Sand: Silica sand meeting requirements of ASTM C33 for fine aggregate.

b. Face Mix Aggregate: Size, type, and color to match finish of approved sample; from single source and of same color for entire Project.

5. Color Pigments: Pure, non-fading mineral oxides conforming to ASTM C979, and designed and mixed to provide uniform color, and does not impair strength of GFRC.

6. Water: Drinkable, free of foreign materials in amounts harmful to GFRC units and embedded steel.

7. Admixtures: Calcium chloride admixtures are not acceptable; acrylic thermoplastic copolymer dispersions may be used.

E. Finish:

1. Color: Integral color as directed by Architect based on manufacturer's full range of colors.

2. Texture: As directed by Architect based on manufacturer's full range of colors.

2.3 ACCESSORIES

A. Anchors, Connecting, and Supporting Devices: Provide ASTM A666 type 304 or 316 stainless steel anchors at any areas where water might be carried over devices to face of GFRC units.

B. Spray-Foam Insulation: Provide foaming type closed cell insulation.

1. Manufacturers:

a. Johns Manville/Corbond III Closed Cell Insulation.
b. CertainTeed/CertaSpray Closed Cell Insulation.
c. BASF/Spraytite Closed Cell Insulation.
d. Substitutions: Refer to Section 01 25 00.

2. Thickness: 1" unless otherwise indicated.

C. Accessories: Provide as indicated, as recommended by system manufacturer, and as required for complete installation as indicated and as required for configurations shown on Drawings.

2.4 FABRICATION

A. Molds: Rigid, constructed of materials providing uniform finished products.

B. Fabricate required connecting devices, plates, angles, (items fit to structural framing members) inserts, bolts, and accessories.

C. Fabricate to allow units to be securely held in place of final installation and adjusted prior to permanent locking in place.

D. Locate lifting devices to allow being cut off and sealed weathertight, if necessary, after units are erected.

E. Ensure anchors, inserts, plates, angles, and other cast-in items are sufficiently embedded and properly located.

F. Prime paint surfaces of connecting and supporting devices, except those embedded in GFRC or requiring field welding; shop prime in two coats.

1. Thoroughly clean surfaces of rust, scale, grease, and foreign matter prior to prime painting.

G. Cure units under near identical conditions to develop concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

H. Ensure finished surfaces of GFRC units are uniform and match accepted sample panel.

I. Fabricate GFRC units straight, true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated on Drawings.

1. Warped, cracked, broken, spalled, stained, or otherwise damaged or defective units will not be acceptable.

J. Insulation: Spray-apply foam insulation in accordance with insulation manufacturer's recommendations and installation instructions and provide protection to prevent damage to insulation and panels during shipping, handling, and installation.

2.5 SOURCE QUALITY CONTROL

A. Fabrication Tolerances: Design for and maintain following fabrication tolerances.

1. Thickness: 1/8" per 10'-0", plus or minus.
2. Maximum Out-of-Square: 1/8" per 10'-0".
3. Maximum Bowing: Length of unit/360.
4. Location of Openings and Cast-In Items: 1/4", plus or minus.

PART 3 - EXECUTION

3.1 PREPARATION

A. Deliver anchorage items to be embedded in other construction before start of such work; provide setting diagrams, templates, instructions, and directions as required for installation.

3.2 INSTALLATION

A. Erect in accordance with manufacturer recommendations and installation instructions and approved shop drawings, without damage to shape or finish.

1. Conform to applicable requirements of referenced standards.

B. Provide for erection procedures, temporary bracing, and induced loads during erection; maintain temporary bracing in place until final support is provided.

C. Securely fasten units in place.

D. Erect units without damage to shape or finish; replace or repair damaged panels.

E. Erect level, plumb, square, and true within allowable tolerances.

F. Align and maintain uniform horizontal and vertical joints, as erection progresses.

G. Installation Tolerances: Maintain following joint tolerances of erected GFRC units:

1. Face Width of Joint: 3/16", plus or minus.

2. Joint Taper: Maximum 1/40" per foot length, with maximum length of taper in one direction of 10-feet.

3. Step in Face Alignment: Maximum 1/8" from one unit to adjacent unit.

4. Jog in Edge Alignment: Maximum 1/8" from panel edge to adjacent panel edge.

3.3 CLEANING

A. Clean weld marks or other marks, debris, or dirt from exposed surfaces.

END OF SECTION

SECTION 07 54 25

ELASTOMERIC TPO MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide reinforced thermoplastic polyolefin (TPO) type elastomeric sheet membrane roofing system with base flashings, insulation, roof deck board, and accessories for complete, weather-tight installation.

B. Related Sections:

1. Section 07 60 00: Flashing and sheet metal.

1.2 REFERENCE STANDARDS

A. National Roofing Contractors Association: NRCA Roofing and Waterproofing Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this section. Require attendance of parties directly affecting roofing work.

1. Review procedures and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Submit membrane manufacturer's literature for membrane and base flashing materials; provide specific recommendations of insulation system manufacturer.

1. Submit membrane manufacturer's recommendations for surface conditioning, flashing, joint cover and crack sealants, and temperature range for application of materials.

B. Shop Drawings: Submit for elastomeric membrane seams, insulation and roof deck board layout; indicate location and insulation type; provide cross section indicating layers of insulation along with R-value calculations.

C. Samples: Submit samples of each exposed material.

D. Certifications:

1. Installer: Submit certification installer is approved for roof system installation.

2. Materials: Submit certification materials and components conform to Specifications and are compatible with each other, roof substrate, and related work.

3. Fire and Wind: Submit manufacturer's certification system conforms to fire and wind requirements.

4. Manufacturer Representative: Submit certification by manufacturer's representative indicating work has been installed in accordance with manufacturer's recommendations and installation instructions.

1.5 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to energy efficiency.

B. Qualification of Installers: Company with minimum five years successful experienced in TPO membrane roof application on projects of similar scope.

1. Installer: Roofing and insulation manufacturer certified or approved.

C. Supervisor: Installer to maintain full-time supervisor/foreman who is on jobsite during roofing work who is experienced in installation of roofing system specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect foam insulation from direct sunlight exposure.

1.7 SITE CONDITIONS

A. Do not apply roofing membrane during inclement weather or when air temperature may fall below 40 degrees F.

1. Do not allow materials to be exposed to moisture during transportation, storage, handling, or installation.

2. Mark damp or wet materials, including felts which froth or foam during installation, and remove from site within 24 hours.

B. Do not apply materials to damp, dirty, dusty, or otherwise unsuitable surfaces.

1. Allow concrete surfaces to cure minimum 28 days.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.8 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Two years.

B. Manufacturer’s Warranty: Submit manufacturer’s warranty including special manufacturer services as required for manufacturer’s warranty.

1. Period: 20 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner’s rights under implied and expressed warranties regardless of wording of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Johns Manville Roofing Systems.

B. Carlisle SynTec Systems.

C. Firestone Building Products Co.

D. GenFlex Roofing Systems Division GenCorp.

E. GAF.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide reinforced thermoplastic polyolefin (TPO) type elastomeric sheet membrane roofing system with base flashings, insulation, roof deck board, and accessories.

1. System: Fully self-adhered exposed membrane.

2. Provide roofing system materials by a single manufacturer, except where materials of other manufacturers are specified or approved by Architect.

3. Provide roof insulation, double layer application where indicated.

4. Provide tapered insulation as required to ensure positive 1/4” per foot slopes to drains.

5. Provide roof deck board to separate insulation from roof membrane.

B. Regulatory Requirements

1. Cool Roof System: Comply with California Building Standards Code requirements for “Cool Roof” system including three-year aged solar reflectance value requirements.

a. Label: System to have Cool Roof Rating Council (CRRC) label.

2. Fire and Wind Resistance: Conform to California Building Standards Code requirements for Underwriters Laboratory (UL) Class A roof system, with UL Class 60 wind resistance classification.

C. Roof Membrane: ASTM D6878, Thermoplastic Poleolefin (TPO) membrane, reinforced, type and thickness as recommended by roof membrane manufacturer for application involved, but no less than 80 mils.

1. System: Comply with NRCA Specification Guide for Thermoplastic Roof Membranes.

2. Provide materials compounded specifically for application methods and substrates indicated on Drawings; comply with requirements for fire rated materials.

D. Insulation: Provide materials approved for use with specified membrane and suitable for application indicated; provide tapered insulation where insulation is indicated to provide roof slopes.

1. Polyisocyanurate Insulation: ASTM C1289, Type II, Class 1, Grade 2 glass fiber faced isocyanurate, with ASTM C1303 Long Term Thermal Resistance (LTTR).

2. Thickness: Not less than 2”.

3. Total Roof R-Value: Comply with Project Title 24 Report.

E. Roof Deck Board: ASTM C1278 with moisture and mold resistant core. Provide as indicated, as required for uniform surface for membrane adherence, and as required for fire and wind ratings.

1. Manufacturers:

a. Georgia Pacific/DensDeck Prime.
b. USG/Securock Ultralight Coated Glass-Mat.
c. Johns Manville/Securock.
d. Substitutions: Refer to Section 01 25 00.

F. Accessories: Provide as recommended by membrane manufacturer and system manufacturer as required for complete weather-tight installation, including, but not limited to:

1. Unreinforced thermoplastic polyolefin membrane flashing.
2. Bonding adhesive.
3. Splicing cement.
4. Lap sealant.
5. Water cut-off mastic.
6. Molded pipe flashing.
7. Temporary sealing, for end of day closing of membrane.
8. Pourable sealer.
9. Nailing strips.
10. Fasteners.

G. Roof Protection Pads: Provide protection materials as recommended by membrane manufacturer where maintenance traffic is anticipated over membrane.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify deck is dry, clean, and smooth, free of depressions, waves, and projections detrimental to roofing membrane, and properly sloped for drainage.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set and that cant strips, nailing strips, and reglets are in place.

C. Beginning installation indicates acceptance of substrate.

D. Metal Surfaces: Remove contaminants which may adversely affect adhesion or performance of roofing system; apply metal primer.

3.2 INSTALLATION

A. Install membrane roofing system in accordance with manufacturer's recommendations and instructions and as required to meet requirements for warranty and applicable codes.

1. Comply with NRCA Specification Guide for Thermoplastic Roof Membranes as applicable. Where conflicts exist comply with manufacturer's recommendations.

B. Insulation: Install insulation in accordance with insulation manufacturer's recommendations and roof membrane manufacturer's recommendations for installation indicated.

1. Place insulation boards butted in close contact and stagger joints between insulation board layers.

2. Bevel insulation to allow snug fit at penetrations; cut neatly around protrusions through roof.

C. Roof Deck Board: Install in accordance with manufacturer recommendations and as required to ensure suitable substrate for membrane roofing over insulation, fire ratings, and wind ratings; secure to roofing deck.

1. Place roof deck boards butted in close contact and stagger joints between roof deck board and insulation board joints.

2. Cut to allow snug fit at penetrations; cut neatly around protrusions through roof.

D. Roof Membrane: Apply membrane in accordance with membrane manufacturer's recommendations and installation instruction. Provide heat welded seams.

1. Apply sheet membrane smooth, free from air pockets, wrinkles, fish-mouths, unlapped joints, or tears, over first layer insulation.

2. Extend roof membrane up vertical surfaces minimum 8" wherever possible and secure to nailing strips or reglets; reinforce corners with double applications of membrane.

3. Install membrane flashings and seal into membrane.

a. Coordinate installation of roof drains and related flashings.

4. Seal flashings and items projecting through membrane; seal terminations with additional layer of membrane and mastic.

E. Roof Protection Pads: Secure roof protection pads in place in accordance with membrane manufacturer recommendations and as required to ensure protection of membrane from roof maintenance traffic.

1. Set pads to allow roof drainage. Where pads cross drainage path set with not less than 4" and not more than 8" between pads.

3.3 FIELD QUALITY CONTROL

A. Site Tests: Flood test roofing prior to installation of insulation and ballast; if defects are revealed, repair and repeat flood test until no defects are revealed.

1. Do not overload structure with flood test; if necessary, section off as necessary.

2. Test for leaks with 2" depth of water maintained for 24 hours.

B. Manufacturer’s Field Services: Manufacturer's representative shall inspect work of Project on regular basis and provide certification roofing system has been installed in accordance with manufacturer's recommendations.

1. Provide unobstructed access to roofing work.

2. Correct defects and irregularities as advised by manufacturer's representative.

3.4 CLEANING

A. Remove roofing membrane markings from finished surfaces.

B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by roofing work, consult manufacturer of finished surfaces for recommended cleaning methods.

C. Leave completed roof free from debris and uniform in appearance.

3.5 PROTECTION

A. Where work must continue over finished roofing membrane, protect surface in accordance with manufacturer recommendations.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide metal flashings and sheet metal including accessories as required for complete weathertight installation.

1. Flashing and sheet metal includes copings, fascia, scuppers, gutters, downspouts, rainwater leaders, reglets, and similar fabricated components as applicable to Project and not provided elsewhere.

a. Provide Schedule 40 hot-dipped galvanized downspouts.

2. Provide concealed sealants used in conjunction with installation of metal flashing and sheet metal.

3. Provide miscellaneous sheet metal flashing and reglets not provided by other trades or suppliers.

a. Where reglets are to be installed in conjunction with other work, provide in adequate time for installation.

B. Related Sections:

1. Section 07 25 00: Concealed flashing at weather barrier/underlayment.
2. Section 07 41 15: Flashing and sheet metal integral with metal roofing.
3. Section 07 95 00: Expansion joint cover assemblies at roofing.

1.2 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Product Data: Furnish literature for manufactured products.

B. Shop Drawings: Clearly indicate dimensioning, layout, general construction details including closures, flashings, locations and types of sealants, anchorages, and method of anchorage.

C. Samples: Furnish samples of typical metal flashing fabrication indicating standard soldered joints and edge conditions.

1.4 DELIVERY, STORAGE AND HANDLING

A. Provide strippable film protective covering on shop finished flashing materials to protect materials through shipping, fabrication, and installation.

1.5 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration. Repair system and pay for or replace damaged materials and surfaces.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide flashing and sheet metal including reglets and accessories as required for complete weathertight installation.

B. Design Criteria: Allow for movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100-year seasonal temperature ranges.

C. Flashing and Sheet Metal:

1. Prefinished High-Performance Coated Aluminum: Manufacturer’s standard two coat thermocured fluoropolymer system containing not less than 70-percent polyvinylidene fluoride resin by weight; AAMA 2605 and AA-C12C42R1x.

a. Manufacturers:

1) ATAS International/PVDF Coil Coated Aluminum.
2) Ryerson Building Products (800.328.7800)/AlumaKlad.
3) Merchant & Evans Industries, Inc. (800.257.6215)/Custom.
4) Substitutions: Refer to Section 01 25 00.

b. Color and Gloss: As selected by Architect from manufacturer's full range of nonmetallic colors.

c. Touch-up Paint for Prefinished Sheet Metal: Type recommended by fluoropolymer manufacturer for field touch-up.

d. Locations: Coping, where indicated on walls, where roof expansion joints go to wall, and were exposed and not provided as part of metal roofing system.

2. Galvanized Steel: ASTM A924 and A653 G90 galvanized steel; minimum 24-gage.

a. Mill phosphatized where indicated to be field painted.

b. Location (Concealed): Where indicated, if not otherwise indicated, provide where flashing will not be exposed to view from exterior of building and where not exposed to view from spaces within building.

c. Steel Pipe Downspouts: ASTM A53, Type S seamless, Schedule 40, with G90 hot-dipped galvanized coating; sizes as indicated.

3. Accessories: Provide strainers, outlet tubes, screens, baffles, hangers, as required for a complete system and complying with SMACNA Manual.

4. Provide heavier gage metal where recommended by SMACNA Manual for size of component.

D. Manufactured Reglets: Snap-on type, for two-piece flashing; metal to match flashing and sheet metal.

1. Manufacturers:

a. Fry Reglet Corp./Springlok System.
b. W.P. Hickman Co./The Leading-Edge Drive Lock System.
c. Substitutions: Refer to Section 01 25 00.

E. Solder and Fasteners: As recommended by SMACNA and complying with applicable codes and regulations; hot dipped galvanized minimum coating comparable to G90.

F. Concealed Sealant: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.

G. Bituminous Paint: Acid and alkali resistant type; black color; asbestos free.

H. Plastic Cement: Cutback asphaltic type; asbestos free.

I. Sealing Compound: Type recommended by roofing manufacturer; asbestos free.

2.2 FABRICATION

A. Fabricate sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

B. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

1. Fabricate corners and intersections in shop with solder joints for watertight fabrication.

C. Form sections in maximum 10'-0" lengths; make allowance for expansion at joints.

D. Hem exposed edges on underside 1/2".

E. Back-paint flashings with heavy bodied bituminous paint where in contact with cementitious materials or dissimilar metals.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with SMACNA Architectural Sheet Metal Manual recommendations for examination and preparation of substrates to receive flashing and sheet metal.

B. Install flashing and sheet metal over surfaces that are dry, free of ridges, warps and voids that could damage underlayment.

C. Coordinate installation with installation of underlayment specified in Section 07 28 00 – Weather Barrier/Underlayment; take special care not to damage underlayment beyond that required to secure flashing and sheet metal in place.

3.2 INSTALLATION

A. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Install tight in place, with corners square, surfaces true and straight in planes, and lines accurate to profiles as indicated on Drawings.

2. Lap joints in direction of water flow.

3. Hold downspouts in position, clear of wall, by hangers spaced not more than 10'-0" on center; securely fasten hangers to wall without exposed damage to wall surface.

B. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.

C. Provide expansion joints concealed within system.

D. Use concealed fasteners, continuous cleat type, except where specifically approved by Architect.

1. Exposed fasteners may be used, where clearly indicated on shop drawings and approved by Architect, at areas not exposed at exterior walls nor in sight of interior spaces.

E. Apply sealing compound at junction of metal flashing and felt flashing.

F. Lock seams and end joints; fit flashing tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Counter-flash mechanical and electrical items projecting through roof membrane.

H. Install sealants where required to prevent direct weather penetration.

I. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.

3.3 CLEANING

A. Remove protective coating from shop finished sheet metal when no longer required to protect roofing and flashing from construction.

B. Touch-up scratched and damaged finish to match new; remove and replace sheet metal units that cannot be repaired to look identical to adjacent sheet metal when viewed from 15'-0" away.

END OF SECTION

SECTION 07 72 00

ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide interior manufactured roof hatches with integral support curb, operable hardware, counterflashing, and accessories as required for complete, installation.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

B. Shop Drawings: Clearly indicate general construction, configurations, jointing methods and locations when applicable, fastening methods and general details.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Babcock-Davis Hatchways, Inc.

B. Bilco Company.

C. Dur-Red Products, Red Plastic Co., Inc.

D. Milcor, Inc.

E. Nystrom Building Products.

F. Substitutions: Refer to Section 01 25 00.

2.2 ROOF HATCHES

A. System Description: Provide manufactured roof hatches, with integral support curb, operable hardware, counterflashing, and accessories.

B. Roof Hatches:

1. Type: Single leaf type.
2. Size: As indicated.

C. Construction: Construct with full welded corner joints, insulated hatch lids, and internal support curbs.

1. Provide complete with integral counter-flashings to roof flashing system and flanges on support curb for anchorage to roof deck.

2. Loading: Capable of supporting minimum 40-psf external loading and 20-psf internal loading pressure.

D. Opening Hardware: Manufacturer's standard manually operating type.

1. Capable of ensuring effortless control and smooth operation without causing damage to hatch or to roofing system.

2. Capable of being opened from beneath and above.

3. Complete with hold-open mechanism and inside padlock hasps.

2.3 FABRICATION

A. Fabricate roof hatches free of visual distortions and defects.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof hatches in accordance with manufacturer's recommendations and instructions for complete installation.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide firestopping as required to maintain effective barrier against spread of flame, smoke, and gases, and to retain integrity of time-rated construction as indicated and at following types of locations.

1. Provide at fire rated system perimeters, and at duct, conduit, piping penetrations through time-rated construction, and as required by applicable codes.

2. Coordinate requirements for firestopping with work involving penetrations through fire rated assemblies.

3. Review Project and Contract Documents to ascertain extent of penetrations in fire rated assemblies and methods included in other sections for maintaining fire ratings.

B. Related Sections:

1. Section 07 90 00: Joint sealants not required to be fire-rated.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate firestopping with fire rated assemblies and penetrations through fire rated assemblies to ensure compliance with applicable codes and regulations to maintain integrity of fire rated assemblies.

1. Firestopping may be integral with some systems and may be specified as part of other systems including mechanical and electrical systems.

B. Coordination with Acoustical Assemblies: Where a firestopping sealant is required at a penetration of an acoustical assembly, provide a fire-rated acoustical sealant such as Pecora/AC-20 FTR, or Hilti/CP 606.

1. Do not use intumescent firestopping at acoustically rated assemblies.

2. Coordinate with Section 09 21 00 – Gypsum Board Assemblies.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature including data for materials and prefabricated devices, including descriptions to identify materials and devices on job.

1. Submit Underwriter's Laboratory approval numbers for required fire ratings. Approval of other laboratories contingent upon acceptance of applicable authorities.

2. Deferred Approvals: Submit data necessary for applicable authorities for each type of firestopping required including firestopping at fire rated assembly junctures, and penetrations through fire rated assemblies.

B. Shop Drawings: Submit manufacturer's installation details.

C. Certificates of Compliance: Submit manufactures' certificates, accompanied by classifications, indicating material or combination of materials used meets requirements specified for flame spread and fire resistance.

1. Certificates to be supported by test reports by nationally recognized testing authority or otherwise satisfactory to authorities.

D. Manufacturer's Instructions: Maintain copy of manufacturer's installation instructions and recommendations at each work area.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with CALGreen requirements relative to finish material pollution control for sealants.

1.5 DELIVERY, STORAGE, AND HANDING

A. Deliver materials in their original unopened packages and store in location providing protection from damage and exposure to elements.

B. Damaged or deteriorated materials shall be removed from site.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. AD Fire Protection Systems/AD Firebarrier Firestopping Materials.

B. Hilti, Corp./Hilti Firestop Systems.

C. 3M Fire Protection Products Div./3M Fire Barrier Products.

D. Specified Technologies, Inc. (STI)/SpecSeal and Pensil Firestopping.

E. Tremco/Firestopping Products.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide firestopping as required to maintain effective barrier against spread of flame, smoke and gases, and to retain integrity of time-rated construction.

1. Choose products and methods meeting applicable codes and Specification requirements for each firestopping application, subject to Architect's acceptance.

B. Regulatory Requirements: Comply with California Building Code, Chapter 7 requirements for firestopping, including both F Ratings and T Ratings as applicable.

C. Design Requirements: Provide materials tested in accordance with following standards, unless otherwise specified.

1. American Society for Testing and Materials (ASTM) Publications:

a. ASTM E84, Surface Burning Characteristics of Building Materials.
b. ASTM E119, Fire Tests of Building Construction and Materials.
c. ASTM E814, Fire Tests of Through-Penetration Fire Stops.
d. ASTM E1966, Test Method for Fire-Resistive Joint Systems.

D. Firestopping Materials: Furnish materials for penetrations in time-rated floor, wall, and partition assemblies capable of preventing passage of flame, smoke, and hot gases.

1. Penetration Test: Furnish materials passing ASTM E814 or E1966 for penetration fire stopping indicating maintenance of time-rated adjacent assemblies.

a. Additional Tests: Where required by applicable authorities, provide materials passing ASTM E119 time-temperature fire conditions for fire ratings indicated for assemblies.

2. Flame Spread: ASTM E84 flame spread rating of 25 or less.

3. Smoke Developed: ASTM E84 smoke developed rating of 450 or less.

E. Firestopping: Maintain fire rating of assembly in which firestopping is installed, such as floor, partition, or wall, in accordance with ASTM E119 tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions are corrected.

3.2 INSTALLATION

A. Install firestopping in accordance with manufacturer's recommendations and installation instructions.

B. Completely fill void space with firestopping materials regardless of geometric configuration, subject to tolerances established by firestopping manufacturer.

C. Apply firestopping materials at penetrations of pipes, conduits, and ducts prior to application of insulation.

1. Remove insulation already in place at penetration prior to application of firestopping materials unless insulation meets requirements for fire ratings indicated.

3.3 FIELD QUALITY CONTROL

A. Inspection: Keep area of work available for inspection by Architect and applicable authorities before and after application of firestopping.

3.4 REPAIR AND CLEAN-UP

A. Repair damage caused by work of this section; clean exposed surfaces soiled by work and leave work ready to receive following work.

B. On completion of work, remove debris, excess materials, and equipment from site.

END OF SECTION

SECTION 07 90 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide joint sealants, for interior and exterior joints not specified elsewhere, with backing rods and accessories as required for complete installation.

1. Joint sealants include joint sealers and calking as indicated.

B. Related Sections:

1. Section 07 41 15: Manufactured metal roofing integral concealed sealants.
2. Section 07 60 00: Flashing and sheet metal concealed sealants.
3. Section 07 84 00: Firestopping type joint sealants.
4. Section 08 80 00: Glazing sealants.
5. Section 09 21 00: Sealants used for acoustical treatment at gypsum board.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: System requires coordination of sealants with multiple substrates, some required to accept bond, some required to prevent bond.

1. It shall be responsibility of this Section to ensure substrates are suitable for providing bond or preventing bond as required for proper sealant installation and longevity.

2. Where substrates are not suitable provide materials as required to ensure bond such as primers and to prevent bond such as bond-breakers.

3. Coordinate with Architect where change of detail or sealant type is required to ensure proper sealant installation.

B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's descriptive literature.

B. Samples: Furnish samples of each type of exposed joint sealer in required colors.

C. Certifications:

1. Furnish manufacturer's certification joint sealers comply with Contract Documents and are suitable for Project applications.

2. Furnish certification indicating installers are trained in proper use of specified products, qualified, and familiar with proper installation techniques.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

1. Provide joint sealants as required by applicable codes and regulations to fill joints and openings in building envelope separating conditioned space from unconditioned space.

B. Installer Qualifications: Firm with minimum five years successful experience on projects of similar type and size, using specified products.

1. Installers shall be familiar with proper application procedures to ensure maximum joint sealer expansion and contraction capabilities.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, cure time, and mixing instructions.

1.6 SITE CONDITIONS

A. Do not proceed with installation of joint sealers under unfavorable weather conditions.

B. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer.

1.7 WARRANTY

A. Extended Correction Period: Extend correction period to two years.

1. Repair or replace joint sealers which fail to perform as intended, because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining, loss of adhesion, and loss of cohesion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide joint sealants with backing rods and accessories.

B. Performance Requirements:

1. Select materials for compatibility with joint surfaces and indicated exposures.

2. Where not indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

3. Comply with applicable limitations on volatile organic compound (VOC) emissions.

C. Regulatory Requirements: Comply with applicable regulatory requirements regarding limitations on volatile organic compound (VOC) emissions limitations.

D. Elastomeric Sealants:

1. Single Component Low Modulus Silicone Sealant: ASTM C920 Type S, Class 25, Grade NS; minimum 50% expansion and compaction capability.

   a. Provide at exterior locations not exposed to traffic.

   b. Manufacturers:

      1) GE (Momentive Performance Materials)/Silpruf, Silglaz or GESIL.
      2) Dow/Dowsil 790 or Dowsil 795.
      3) Pecora Corp./864 Architectural Silicone.
      4) Tremco/Spectrem 3.
      5) Substitutions: Refer to Section 01 25 00.

2. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade P, Class 25, self-leveling; minimum 25% expansion and compaction capability.

   a. Provide at traffic bearing locations.

   b. Manufacturers:

      1) Pecora Corp./Urexpan NR-200, or Dynatrol II-SG.
      2) Tremco/THC 900-901, or Vulkem 445 SSL.
      3) BASF/MasterSeal SL 2
      4) Substitutions: Refer to Section 01 25 00.

3. Mildew-Resistant Silicone Rubber Sealant: ASTM C920, Type S, Grade NS, Class 25, compounded with fungicide, specifically for mildew resistance and recommended for interior joints in wet areas.

   a. Provide at interior joints in wet areas.

   b. Manufacturers:

      1) GE (Momentive Performance Materials)/SCS 1702 Sanitary Sealant.
      2) Dow/786 Bathtub Caulk.
      3) Pecora Corp./898 Sanitary Mildew Resistant Sealant.
      4) Tremco/Tremsil 200.
      5) Substitutions: Refer to Section 01 25 00.

E. Non-Elastomeric Sealants:

1. Acrylic-Emulsion Sealant: ASTM C834 acrylic or latex-rubber-modified acrylic sealant, permanently flexible, non-staining, and non-bleeding; recommended for general interior exposure; compatible with paints specified in Section 09 90 00.

   a. Provide at general interior applications.

   b. Manufacturers:

1) Pecora Corp./AC-20.
2) Tremco/Tremflex 834.
3) Substitutions: Refer to Section 01 25 00.

2. Air Seals: Provide non-staining and non-bleeding sealers, calks, or foams appropriate to specific applications for filling openings between conditioned and unconditioned spaces.

   a. Type: As recommended by manufacturer for each specific application; compatible with adjacent materials.

   b. Manufacturers:

      1) Dow/Great Stuff.
      2) Owens Corning/EnergyComplete Air Sealant.
      3) Hilti/Foam Filler CF 812.
      4) Substitutions: Refer to Section 01 25 00.

   c. Pest Control Mesh: Openings subject to pest infiltration to have 304 stainless steel wool, material stuffed in joint before application of air seals using methods to ensure blocking of gap from pests.

F. Miscellaneous Materials:

1. Primers/Sealers: Non-staining types recommended by joint sealer manufacturer for joint surfaces to be primed or sealed.

2. Joint Cleaners: Non-corrosive types recommended by joint sealer manufacturer; compatible with joint forming materials.

3. Bond Breaker Tape: Polyethylene tape as recommended by joint sealer manufacturer where bond to substrate or joint filler must be avoided for proper performance of joint sealer.

4. Sealant Backer Rod: Closed cell compressible polyethylene foam rod or other flexible, permanent, durable non-absorptive material as recommended by joint sealer manufacturer for compatibility with joint sealer.

   a. Oversize backer rod minimum 30% to 50% of joint opening.

G. Colors: As indicated, as selected by Architect from manufacturer's full range of colors where not indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare joint surfaces in accordance with ASTM C1193 and as recommended by joint sealer manufacturer.

B. Clean joint surfaces immediately before installation of joint sealer; remove dirt, insecure materials, moisture, and other substances which could interfere with bond of joint sealer.

C. Prime or seal joint surfaces when recommended by joint sealer manufacturer; do not allow primer/sealer to spill or migrate onto adjoining surfaces.

D. Ensure protective coatings on surfaces in contact with joint sealers have been completely stripped.

3.2 INSTALLATION

A. Comply with manufacturer's printed instructions and ASTM C1193, except where more stringent requirements are shown or specified.

B. Pest Control: Install stainless steel wool prior to application of backer rods and bond breakers at air seal and as required to ensure complete pest blockage at joints where pest intrusion is a potential.

C. Set sealant backer rods at proper depth or position in joint to coordinate with other work, including installation of bond breakers and sealant; do not leave voids or gaps between ends of backer rods.

1. Do not stretch, twist, puncture, or tear backer rods.

D. Install bond breaker tape as required to avoid three-sided bond of sealant to substrate and where required by manufacturer's recommendations to ensure joint sealers will perform properly.

E. Size materials to achieve required width/depth ratios.

F. Employ installation techniques that will ensure joint sealers are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of bond surfaces equally on opposite sides.

G. Joint Configuration: Fill sealant joint to a slightly concave surface, slightly below adjoining surfaces, unless otherwise indicated.

H. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.

I. Install joint sealers to depths recommended by joint sealer manufacturer but within the following general limitations, measured at center (thin) section of bead.

1. Horizontal Joints: 75% width with minimum depth of 3/8".
2. Elastomeric Joints: 50% width with minimum depth of 1/4".
3. Non-Elastomeric Joints: 75% to 125% of joint width.

J. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.

1. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

K. Cure joint sealers in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.

L. Maintain finished joints free of embedded matter, ridges, and sags.

END OF SECTION

SECTION 07 95 00

EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide shop fabricated elastomeric expansion joint cover assemblies, metal and elastomeric types as indicated, including anchors and accessories as required for complete installation.

1. Provide weather-tight exterior joint cover assemblies, with metal retainers, including anchors and accessories as required for complete installation.

B. Related Work:

1. Section 07 60 00: Flashing and sheet metal.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each joint cover assembly.

B. Shop Drawings: Indicate method of connection to structure.

C. Samples: Submit samples of each type of exposed finish material.

D. Certificates: Submit manufacturer representative’s certification indicating exterior joint cover assemblies have been installed in accordance with manufacturer recommendations and instructions.

1.4 WARRANTY

A. Extended Correction Period: Provide for correcting failure of exterior expansion and compression joint cover assemblies to resist wind and to maintain weather-tight closure under anticipated movement and conditions.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Balco Inc.

B. Construction Specialties, Inc. C-S Group.

C. Nystrom Building Products.

D. Inpro Corp. JointMaster Systems.

E. MM Systems, Inc.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide shop fabricated elastomeric expansion joint cover assemblies, metal and elastomeric types as indicated, including anchors and accessories.

1. Provide each type of joint cover assembly as a system from a single manufacturer; provide exterior wall and roof joint cover assemblies from a single manufacturer.

2. Provide factory fabricated connection between exterior wall and roof joint covers.

B. Aluminum: ASTM B221 alloy 6063-T5 for extrusions; ASTM B209, alloy 6061-T6, sheet and plate

1. Metal Finishes:

a. Aluminum Contact Surfaces on Concrete: Zinc chromate primer.
b. Aluminum Covers: Clear anodic coating.

2. Wearing Surfaces: Manufacturer's standard, of type shown on Drawings.

3. Protection: Cover exposed metal surfaces with factory-applied adhesive paper or polyvinyl chloride (PVC) protective strippable coating.

C. Elastomeric Seals: Manufacturer's standard durometer consistent with joint size and application.

1. Functional Seal: ASTM C509 closed cell neoprene as recommended by manufacturer for application indicated and as needed to assure weathertight exterior applications.

2. Visual Seals: ASTM C864 dense silicone; color as selected by Architect from manufacturer's full range of available colors.

3. Lubricants/Adhesives: Type as recommended by system manufacturer for specific material and application.

4. Sealants at Elastomeric Seals: Type as recommended by seal manufacturer to maintain integrity of weather barrier.

D. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible seal, and filler materials, adhesive and accessories compatible with material in contact.

1. Exterior Anchors: Minimum Series 300 stainless steel.
2. Elastomeric Seal Corner Angle Reinforcing: Minimum Series 304 stainless steel.

2.3 FABRICATION

A. General: Furnish basic profile and operating units for expansion joint covers as indicated on Drawings.

1. Joint Cover Types: As indicated and as approved by Architect.

B. Shop Assembly: Assemble items in shop to minimize field splicing and assembly of units at Project site.

C. Furnish longest practicable lengths to minimize number of end joints.

1. Seals: Continuous between intersections with joints mitered, reinforced with stainless steel angles, and sealed with joint sealer.

2. Functional Seals: Continuous where possible.

3. Intermediate Drains: Provide at exterior joint cover assemblies as required to allow water to drain to exterior.

4. Interior Seals: Continuous between intersections with joints mitered. Reinforce joints with stainless steel angles.

D. Provide hairline mitered corners where joint changes direction or abuts other material systems.

E. Provide factory fabricated custom fit end closers at exposed ends of joint cover assemblies.

F. Provide separator coat between aluminum and dissimilar materials to prevent electrolysis and to protect aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible.

1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

2. Furnish setting drawings for installation of anchorages to be embedded in adjacent construction; coordinate delivery of such items to Project site so as to prevent delay of construction.

B. Examine areas and conditions under which expansion joint covers are to be installed.

C. Coordinate with adjacent systems to ensure acceptable conditions for installation of expansion joint cover assemblies.

D. Do not proceed with work until unsatisfactory conditions have been corrected, start of installation indicated acceptance of conditions.

3.2 INSTALLATION

A. Manufacturer's Instructions: Comply with manufacturer's instructions and recommendations, including preparation of substrate, applying materials and protection of installed units.

B. Cutting, Fitting and Placement:

1. Perform cutting, drilling, and fitting required for installation.

2. Set work accurately in location, alignment, and elevation, plumb, level, true, measured from established lines and levels.

3. Install joint cover assemblies in true alignment.

4. Hold end joints to minimum; make end joints with strong, rigid, mechanical splice plate in true alignment, with hairline joints.

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Services: Manufacturer’s representative to visit site and provide written certification indicating exterior expansion joint covers have been installed in accordance with manufacturer recommendations and instructions.

3.4 CLEANING AND PROTECTION

A. Do not remove strippable protective material until finish work in adjacent areas is complete.

B. When protective material is removed, clean exposed metal surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 08 11 10

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide exterior full flush steel (hollow metal) doors and pressed steel exterior and interior frames, including anchors and silencers.

1. Provide metal louvers at hollow metal doors.

B. Related Sections:

1. Section 08 71 00: Door hardware.

1.2 REFERENCES

A. Steel Door Institute (SDI): SDI-100 (ANSI/SDI A250.8) - Recommended Specifications - Standard Steel Doors and Frames.

B. National Association of Architectural Metal Manuf. (NAAMM): Hollow Metal Manual.

C. Underwriters Laboratories: Standards as applicable to fire rated doors and frames.

1. Materials tested, labeled, and inspected by Warnock Hersey International are acceptable upon approval of authorities.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate hardware installation with Section 08 71 00 – Door Hardware.

1.4 SUBMITTALS

A. Product Data: Submit manufacturers' literature.

B. Shop Drawings: Indicate general construction, configuration, jointing methods, reinforcement, anchorage methods, hardware locations, and locations of cut-outs.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Amweld Building Products Inc.

B. Ceco Door Division Assa Abloy Door Group.

C. Curries Division Assa Abloy Door Group.

D. Door Components, Inc.

E. Republic Doors and Frames.

F. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide full flush steel (hollow metal) doors and pressed steel frames, including anchors and silencers.

B. Doors: Hollow metal flush steel door, minimum 0.053” (16-gage), 1-3/4" thick.

1. Typical: Full flush with steel channel or welded edge; close top with flush end closer treatment, bottom optional flush, or recessed channel; steel stiffened core, insulated; continuous welded seam.

2. Louver Doors: Provide systems as indicated on Drawings.

C. Frames:

1. Exterior Frames: Welded (pre-assembled) type.

2. Interior Frames: Knockdown (field-assembled) type; provide 3/8” back bend return on frames at gypsum board.

3. Gage: Minimum 0.053” (16-gage) interior frames, 0.067” (14-gage) exterior frames.

4. Door Silencers: Manufacturer's standard resilient type; removable for replacement.

D. Fire Rated Units: Construct in accordance with requirements for fire rating, NFPA 252 or UL 10C, and NFPA 80.

1. Labels: Place fire rating labels where visible when doors and frames are in installed, opened position.

2. Fire Ratings: Refer to Drawings for fire rating requirements.

E. Door Louvers: Weatherproof Z-shaped blades with U-shaped frames; 1-3/8" thick; blades 1-1/2" on center; 0.053” (16 gage) welded construction.

1. Provide removable bird screens on interior faces, 1/2" by 1/2" bronze wire mesh.

2.3 FABRICATION

A. Conform to requirements of SDI (ANSI A250 Series) or NAAMM.

B. Reinforce and prepare doors and frames to receive hardware.

1. Refer to Section 08 71 00 for hardware requirements.

C. Frames:

1. Welded Frames: Accurately form and cut mitered corners of welded type frames; continuously weld on inside surfaces (fully welded); grind welded joints to smooth uniform finish.

2. Head Reinforcement: Reinforce frames wider than 4'-0" with minimum 0.093” (12 gage) formed steel channels welded in place, flush with top of frames.

D. Door Silencers:

1. Place three single bumpers on single door frames; space equally along strike jambs.

2. Place two single bumpers on double door frames; place on frame heads.

E. Provide jamb anchors per SDI-100 (ANSI/SDI 250.8) and NAAMM and weld floor jamb anchors in place.

F. Edge Clearances:

1. Between Doors and Frames: Maximum 1/8" at head and jambs.
2. Door Sills (No Threshold): Maximum 1/2".
3. Door Sills (Threshold): Maximum 3/8" above finished floor.
4. Between Edges of Pairs of Doors: Maximum 1/8".
5. Fire Rated Doors: As required for fire ratings.

G. Finish: Comply with requirements of Section 09 90 00 – Painting and Coating for primer including application and compatibility with specified finishes.

1. Interior Units: Prime paint.

2. Exterior Exposed Units: Apply minimum A60 non-spangle galvanized coating, ASTM A924 and A653.

a. Surface treat after galvanizing to remove oils and prepare for painting and apply one coat of primer; comply with requirements in Section 09 90 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors and frames in accordance with SDI-100 (ANSI/SDI A250.8) and ANSI/SDI A250.11 or NAAMM "Hollow Metal Manual" and with manufacturer's recommendations and installation instructions.

1. Install fire rated units in conformance with fire label requirements and NFPA 80.

B. Install doors and frames plumb and square within 1/16”, and with maximum diagonal distortion of 1/32".

C. Remove and replace doors and frames damaged during delivery, storage, installation, and construction.

1. Paste filler repair shall not be permitted.

D. After installation, touch-up scratched paint surfaces.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide flush wood doors as indicated.

1. Contractor Option: Provide shop finished wood doors.

B. Related Work

1. Section 08 11 10: Pressed steel frames.
2. Section 08 71 00: Door hardware.
3. Section 08 80 00: Glass and glazing for wood doors.

1.2 REFERENCES

A. North American Architectural Woodwork Standards (NAAWS).

B. Window and Door Manufacturer’s Association (WDMA): Guide Specifications.

C. Underwriters Laboratories Inc. (UL): Building Materials Directory.

1. Materials tested, labeled, and inspected by Warnock Hersey International are acceptable upon approval of authorities.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Hardware: Coordinate hardware installation with Section 08 71 00 – Door Hardware.

2. Glazing: Coordinate glazing with Section 08 80 00 – Glazing.

3. Painting: Coordinate with Section 09 90 00 – Painting and Coating whether wood doors are to be shop finished or field painted.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's literature.

B. Shop Drawings: Indicate general construction, jointing methods, hardware locations, and locations of cut-outs.

C. Samples: Submit samples of wood doors indicating construction, veneering, and finish.

1. Submit shop finish for wood doors where doors are furnished shop finished.

D. Certificates: Submit manufacturer certification indicating compliance to applicable requirements of either NAAWS or WDMA Standards; note which standards were followed or if both standards have been met.

1.5 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for composite wood products formaldehyde limitations and paints and coatings.

1.6 SITE CONDITIONS

A. Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized in accordance with referenced standards requirements applicable to Project location.

1.7 WARRANTY

A. Extended Correction Period: Provide for replacing, rehanging, and refinishing wood doors exhibiting defects in materials or workmanship including warp and delamination.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. VT Industries including Eggers.

B. Masonite Architectural including Marshfield and Algoma.

C. Haley Brothers, Inc.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide flush wood doors as indicated.

B. Solid Core Flush Wood Doors: NAAWS/Premium Grade, 5 Ply Hot Press, 1-3/4" thick solid wood framed glued block construction or particleboard core five ply construction; Contractor option to use WDMA comparable standards.

1. Transparent/Stained Wood Veneers: NAAWS/Premium Grade veneers for transparent/stained finish; nominal 1/40" thick before sanding, not less than 1/50” after sanding.

a. Wood Veneers: Vertical Grain Clear Douglas Fir unless otherwise indicated.

2. Opaque Painted Wood Veneers: NAAWS/Custom Grade White Birch veneers for opaque finish; nominal 1/40" thick before sanding, not less than 1/50” after sanding.

3. Edges: Stile edges to match face veneer, minimum 1-1/8" thick after trim.

4. Core: Bond stiles and rails to core and sand prior to assembly of face veneers.

5. Bond Type: Provide Type II Bond for interior doors.

6. Fire Rated Flush Wood Doors: 1-3/4" thick, match non-rated door appearance; comply with applicable codes; UL or Warnock Hersey rated.

    a. Labels: Place fire rating labels where visible when doors are installed, in opened position.

    b. Fire Ratings: Refer to Drawings for fire rating requirements.

    c. Core: Use wood core construction for 20 minute rated flush doors, mineral core permitted for longer ratings.

2.3 FABRICATION

A. Fabricate doors in accordance with requirements of specified standards.

1. Prefit wood doors.

2. Prepare doors to receive hardware in shop, refer to Section 08 71 00 for hardware requirements and templates.

3. Factory machine doors for mortise hardware.

B. Bevel strike edge of single-acting doors, 1/8" in 2".

C. Fire Rated Doors: Fabricate fire rated doors in accordance with requirements of Underwriters' Laboratories (UL) or Warnock Hersey International.

1. Provide fire rated doors with maximum allowable edge strips, of wood species to match face veneers.

2. Provide doors with blocking designed for addition of closers, even where doors are not indicated to receive closers.

3. Provide astragals and metal edge trim for double doors, in accordance with requirements for fire rated doors.

D. Make cut-outs and provide matching wood stops for glass; profiles as indicated, type as selected by Architect where not otherwise indicated.

1. Fire Rated Doors: Provide minimum 18-gage metal stops conforming to fire rating requirements.

E. Shop Finished Doors (Contractor Option): Conform to requirements specified in Section 09 90 00 – Painting and Coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood doors in accordance with manufacturer's recommendations and installation instructions, and reference standards, plumb and square, and with maximum diagonal distortion of 1/16".

1. Install fire rated wood doors in accordance with requirements for specified fire label and requirements of NFPA 80.

a. Field cutting of fire rated doors shall not be acceptable.

B. Rehang or replace doors which do not swing or operate freely.

3.2 PROTECTION

A. Protection: Protect doors as recommended by door manufacturer to ensure doors are without damage at time of Substantial Completion.

1. Shop Finished Doors: Refinish or replace damaged doors.

END OF SECTION

SECTION 08 35 40

SLIDING ALUMINUM AND GLASS WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide exterior sliding aluminum and glass walls with hardware, anchorage, glazing, and accessories as required for complete installation.

B. Related Sections:

1. Section 07 90 00: Perimeter sealants and back-up materials.
2. Section 08 44 00: Aluminum curtain walls including entrances and storefronts.
3. Section 08 71 00: Key cylinders.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA), AAMA 101-2017 North American Fenestration Standard.

B. Glass Association of North America (GANA): Glazing Manual.

C. National Assoc. of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents.

B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's literature.

B. Shop Drawings: Indicate pertinent dimensioning, general construction, component connections and locations, anchor methods and locations, hardware locations, and relevant details.

C. Samples: Furnish samples of metal finish, glass, and glazing gasket.

D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

1.5 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to energy efficiency.

1.6 WARRANTY

A. Extended Correction Period: Extend correction period to two years.

1. Provide for correcting failure of Sound Transmission Coefficient rating (STC).

2. Provide for correcting failure of insulating glass. Failure includes signs of moisture on interior surfaces of insulated glass units.

3. Repair or replace systems and materials which fail to perform as intended.

B. Manufacturer’s Warranty: Submit manufacturer’s warranty including special manufacturer services as required for manufacturer’s warranty.

1. Period: 20 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner’s rights under implied and expressed warranties regardless of wording of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. LaCantina Doors, Oceanside, CA (888.221.0141).

B. NanaWall Systems, Inc. Mill Valley, CA. (800.873.5673).

C. C.R. Laurence Co., Los Angeles, CA (800.421.6144).

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide sliding aluminum and glass walls with hardware, anchorage, glazing, and accessories.

B. Performance Criteria Requirements: Conform to AAMA 101 for HGD-R20 rating or better.

1. Strength: Design system to withstand wind loads acting normal to plane of walls as required by California Building Code but no less than following minimum requirements:

a. Wind Loads: Minimum 20-psf acting inward and outward.

b. Deflection: Maximum L/175, ASTM E330.

c. Safety Factor: Design for specified pressures with no glass breakage, no permanent damage to fasteners, and no permanent deformation of framing in exceeding 0.2% of member clear span.

C. Regulatory Requirements, General: Comply with applicable California Building Code load requirements, without breakage, failure of any part, or malfunction of operation.

D. Regulatory Requirements for Glazing: Comply with CPSC 16 CFR 1201, applicable code requirements, and pass ANSI Z97.1.

E. California Title 24 CEC Regulatory Requirements: Comply with California Energy Commission requirements regarding energy performance of walls.

1. Manufacturer shall be responsible for providing information required by authorities necessary to verify conformance.

2. Entire assembly, including glass and glazing, shall be certified by National Fenestration Rating Council (NFRC) and shall bear NFRC Label indicating energy performance technical information.

F. Accessibility Regulatory Requirements: Provide for assuring access for persons with disabilities in accordance with state and federal regulations.

1. California Regulations: Comply with California Building Standards Code.

2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.

G. Sliding Aluminum and Glass Walls: System with profiles as indicated on Drawings; provide extruded aluminum security type glass stops of profile to suit frame design.

1. Basis of Design: LaCantina.

2. Aluminum Type: As recommended by manufacturer for application indicated, but not less than extruded aluminum, ASTM B221, 6061 or 6063 alloy and T5 or T6 temper.

3. Finish: Fluoropolymer system based on Kynar 500 or Hylar 5000; conform to NAAMM Metal Finishes Manual and AAMA 605.2.

a. Color: Match curtain wall system in Section 08 44 20 as directed by Architect.

H. Hardware: Barrier-free sliding wall system meeting code requirements for providing access for people with physical disabilities; by system manufacturer.

1. Metal and Finish: Match wall system.

2. Hardware: Provide manufacturer's complete standard hardware system except as indicated; match sliding wall finish unless otherwise indicated.

a. Cylinders: Provided under Section 08 71 00.

b. Flat Handles: Powder coat finish; color as selected by Architect.

c. Sills: As indicated on Drawings, as selected by Architect from manufacturer's full range of sills (including sill-less) where not otherwise indicated.

I. Glass: Coordinate glazing with sliding wall system.

1. Manufacturers:

a. Vitro Archietctural Glass (formerly PPG).
b. Oldcastle Glass.

c. Guardian Industries Corp.
d. Substitutions: Refer to Section 01 25 00.

2. Insulated Glass: Preassembled insulated glass units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with minus 20-degree F dew point and with STC ratings indicated.

   a. Performance: ASTM E2190 certified by Insulating Glass Certification Council.

   b. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.

   c. Safety Glass: ASTM C1048, Kind FT, fully tempered select glazing quality glass, safety glazing; nominal thickness 1/4".

   d. Low E Coating: High performance low emissivity coating comparable to Vitro (PPG)/SolarBan 70 on No. 2 surface.

   e. Total Unit Thickness: 1".

J. Glazing Accessories: Of type recommended by manufacturer to suit security locations and applications for dry glazing installation.

   1. Setting Blocks: Neoprene or EPDM, 80-90 Shore A durometer hardness; 4" long by 3/8" thick by 1/4" high; ASTM C864.

   2. Spacer Shims: Neoprene or EDPM; 45-55 Shore A durometer hardness; 3" long by 3/32" thick by 1/4" high; ASTM C864.

   3. Edge Blocks: Neoprene or EPDM, 60-70 Shore A durometer hardness; 4" long with minimum two per jamb located at top and bottom edges of glass; ASTM C864.

   4. Glazing Gaskets: Exterior neoprene or EDPM; interior neoprene, EPDM or vinyl; miter corner joints; ASTM C509 or C864.

K. Miscellaneous Materials:

   1. Fasteners: Aluminum or non-magnetic stainless steel of type that will not cause electrolytic action or corrosion.

      a. Do not use exposed fasteners except where unavoidable for assembly or for application of hardware.

      b. Indicate exposed fasteners on shop drawings for specific approval; exposed fasteners shall be Phillips flat-head screws or Allen screws with finish matching item fastened.

      c. Provide concealed fasteners for glazing stops.

   2. Steel Reinforcement and Brackets: Manufacturer's standard with minimum 2 oz. hot-dip zinc coating, ASTM A123, applied after fabrication.

   3. Bituminous Paint: Cold-applied mastic, SSPC Paint 12, compounded for 30 mil thickness per coat.

4. Anchoring Devices: Corrosion resistant type capable of supporting walls system and superimposed design loads; design to allow adjustments of system prior to being permanently fastened in place.

2.3 FABRICATION

A. Fabricate sliding wall system to allow for clearances and shim spacing around perimeter of assemblies to enable installation; provide for thermal movement.

B. Provide anchorage devices to securely and rigidly fit walls assemblies in place.

C. Accurately fit together joints and corners; match components ensuring continuity of line and design; ensure joints and connections are flush, hairline, and weatherproof.

D. Provide structural reinforcing within framing members where required to maintain rigidity and as required to accommodate design loads.

E. Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, treatment, and application of coating.

F. Finishing: After fabrication, prepare surfaces for finishing in accordance with recommendations of aluminum producer and finish manufacturer.

1. Finish components of each assembly simultaneously to attain uniformity of color.

G. Weld by methods recommended by metal manufacturer and AWS; grind exposed welds smooth and restore mechanical finish; remove arises from cut edges and corners to a radius of approximately 1/64".

H. Fit and assemble work at shop to greatest extent possible; disassemble only as required for shipment and erection.

I. Reinforce work as necessary for performance requirements and for support.

1. Provide internal reinforcing for hardware.

J. Separate dissimilar materials with bituminous paint or preformed separators which will prevent corrosion.

K. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts that permanently prevent "freeze-up" of joint.

L. Fabricate and apply hardware, disassemble only as required for transportation and installation.

M. Apply coat of bituminous paint on concealed aluminum surfaces to be in contact with cementitious and with dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square and within wall manufacturer recommended tolerances.

B. Beginning of work constitutes acceptance of existing conditions.

3.2 INSTALLATION

A. Install sliding walls in accordance with manufacturer's recommendations and to meet design requirements indicated, for weathertight installation.

B. Ensure sliding walls are plumb, level, and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.

1. Maximum Variation from Plane or Location: 1/8" in 12'-0", with maximum 1/2" variation in total length.

2. Maximum Offset Between Members: 1/16".

C. Use sufficient anchorage devices to secure and rigidly fasten system to building.

D. Install hardware in accordance with manufacturer's recommendations, using proper templates.

1. Install to operate freely and smoothly, with a maximum operating pressure of 5 pounds in accordance California Title 24 and with ADA Standards.

2. Coordinate installation of cylinders with Section 08 71 00.

E. Glass Installation: Comply with GANA Glazing Manual and glazing manufacturer instructions.

1. Do not allow glass to touch metal surfaces.

3.3 CLEANING

A. Clean aluminum surfaces promptly after installation of components, exercising care to avoid damage of finish.

B. Remove nonpermanent labels immediately after sealant cures and cure sealants for high early strength and durability.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged during construction period, including natural causes, accidents, and vandalism.

END OF SECTION

SECTION 08 41 00

ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide aluminum-framed entrances and storefront systems, with stock non-automatic doors, hardware, anchorage, glazing, and accessories as required for complete installation.

B. Related Sections:

1. Section 07 90 00: Perimeter sealants and back-up materials.
2. Section 08 11 20: Interior aluminum frames.
3. Section 08 44 30: Channel glass assemblies.
4. Section 08 51 10: Aluminum fixed and projected windows.
5. Section 08 71 00: Cylinders for door locks
6. Section 08 71 15: Low energy automatic door operators.

1.2 REFERENCES

A. American Architectural Metal Manufacturers (AAMA): Aluminum Store Front and Entrance Manual.

B. Glass Association of North America (GANA): Glazing Manual.

C. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Design/Build: Provide special engineering for entrances and storefronts to ensure they comply with applicable codes and Contract Documents.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's literature.

B. Shop Drawings: Indicate pertinent dimensioning, general construction, component connections and locations, anchor methods and locations, hardware locations, and relevant details.

C. Samples: Furnish samples of metal finish, glass and glazing gasket.

D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

1.5 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to energy efficiency.

B. Installer Qualifications: Manufacturer or firm with minimum five years successful experience in the installation of systems similar to type and size required for Project and approved by manufacturer.

1.6 WARRANTY

A. Extended Correction Period: Provide for correcting failures including wind damage and water penetration to interior surfaces, excessive deflections, and deterioration of finishes, weather-stripping and accessories.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Kawneer, an Arconic Company.

B. Oldcastle Building Envelope.

C. Arcadia, Inc.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide aluminum-framed entrances and storefront systems, with stock non-automatic doors, hardware, anchorage, glazing, and accessories.

1. Basis of Design: Oldcastle Building Envelope Series 6000.

B. Regulatory Requirements, General: Comply with requirements of applicable codes.

1. Safety Glass Standard: Comply with applicable codes and CPSC 16 CFR 1201 and pass ANSI Z97.1.

C. Regulatory Requirements, California Energy Code: Comply with California Energy Commission requirements regarding energy performance of aluminum framed storefronts.

1. Manufacturer shall be responsible for providing information required by authorities necessary to verify conformance.

2. Entire assembly, including glass and glazing, shall be certified by the National Fenestration Rating Council (NFRC) and shall bear NFRC Label indicating energy performance technical information.

D. Regulatory Requirements, Accessibility: Comply with requirements of California Building Code and Americans with Disabilities Act (ADA) Standards to ensure access to persons with disabilities.

E. Design Criteria: Comply with recommendations of AAMA Aluminum Store Front and Entrance Manual except where more stringent requirements are specified.

1. Deflection: Maximum L/175, ASTM E330.

a. Safety Factor: Design for specified pressures with no glass breakage, no permanent damage to fasteners, and no permanent deformation of framing exceeding 0.2% of member clear span.

2. Water Penetration: No uncontrolled water penetration, ASTM E331, with no water on exposed interior components; static pressure differential of 20% of inward wind load, with minimum 6-psf load.

3. Air Leakage: Maximum 0.06 cfm/sf, ASTM E283, at differential static pressure of 6.24-psf at fixed glazing and not more than 0.3 cfm/sf at doors.

F. Performance Criteria: Design assemblies capable of withstanding minimum uniform test pressures as required by applicable codes when tested in accordance with ASTM E330.

G. Aluminum-Framed Entrance and Storefront Systems: Systems with profiles as indicated on Drawings; provide extruded aluminum security type glass stops of profile to suit frame design.

1. Basis of Design: Kawneer/Trifab VersaGlaze 451T Framing System.

2. Aluminum Type: As recommended by manufacturer for application indicated, but not less than extruded aluminum, ASTM B221, 6061 or 6063 alloy and T5 or T6 temper.

3. Finish, Clear Anodized: Clear anodized coating conforming with NAAMM Metal Finishes Manual, Architectural Class I, 0.7 mil or greater.

H. Doors, Frames, and Hardware: Barrier-free entry doors meeting code requirements for providing access for people with physical disabilities; by entrance manufacturer.

1. Type: Wide stile, nominal 5-1/2” wide stiles and head rail with 10" bottom rail.

2. Metal and Finish: Match entrance system.

3. Hardware: Provide complete hardware system except as indicated; match window wall system finish unless otherwise directed by Architect. Coordinate with Section 08 71 00 – Door Hardware.

a. Hinges: Extra heavy-duty ball bearing full mortise (butt) hinges complying with requirements specified in Section 08 71 00.

b. Closers: Concealed adjustable type closer, maximum 5-pound operating pressure when installed in final application.

c. Panic Devices: Types as indicated on Drawings; where not otherwise indicated manufacturer's standard types as selected by Architect; match finish of similar hardware as specified in Section 08 71 00.

d. Security Locks: Manufacturer's standard.

1) Cylinders: Provided under Section 08 71 00.

e. Weather-Stripping, Sweep Strips: Manufacturer's recommended standard type, to suit application.

f. Thresholds: Maximum 1/2" height above adjacent surfaces, with maximum 1/4" vertical section and remainder maximum 1:2 slope.

I. Glass: Provide minimum thicknesses specified, but no less than thicknesses required based on window size and configuration and anticipated wind loading.

1. Manufacturers:

a. Vitro Architectural Glass (formerly PPG).
b. Oldcastle Glass.
c. Guardian Industries Corp.
d. Viracon.
e. Substitutions: Refer to Section 01 25 00.

2. Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with minus 20-degree F dew point.

a. Performance: ASTM E2190 certified by Insulating Glass Certification Council.

b. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.

c. Float Glass (Typical): Select glazing quality, clear float glass, ASTM C1036; nominal thickness 1/4".

d. Tempered Glass (Doors, Where Indicated and Where Safety Glazing is Required): Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.

e. Low Emissivity Coating: Provide high performance low e coating, not less than Vitro (PPG)/SolarBan 70XL, on Number 2 surface.

f. Total Unit Thickness: 1".

J. Glazing Accessories: Of type recommended by manufacturer to suit security locations and applications for dry glazing installation.

1. Setting Blocks: Neoprene or EPDM, 80-90 Shore A durometer hardness; 4" long by 3/8" thick by 1/4" high; ASTM C864.

2. Spacer Shims: Neoprene or EDPM; 45-55 Shore A durometer hardness; 3" long by 3/32" thick by 1/4" high; ASTM C864.

3. Edge Blocks: Neoprene or EPDM, 60-70 Shore A durometer hardness; 4" long with minimum two per jamb located at top and bottom edges of glass; ASTM C864.

4. Glazing Gaskets: Exterior neoprene or EDPM; interior neoprene, EPDM or vinyl; miter corner joints; ASTM C509 or C864.

K. Miscellaneous Materials:

1. Fasteners: Aluminum or non-magnetic stainless steel of type which will not cause electrolytic action or corrosion.

a. Do not use exposed fasteners except where unavoidable for assembly or for application of hardware.

b. Indicate exposed fasteners on shop drawings for specific approval; exposed fasteners shall be Phillips flat-head screws or Allen screws with finish matching item fastened.

c. Provide concealed fasteners for glazing stops.

2. Steel Reinforcement and Brackets: Manufacturer's standard with minimum 2 oz. hot-dip zinc coating, ASTM A123, applied after fabrication.

3. Bituminous Paint: Cold-applied mastic, SSPC Paint 12, compounded for 30 mil thickness per coat.

4. Flashing: Provide sub-sill flashing members; minimum 22 gage sheet aluminum of sizes and shapes indicated and as required to drain water to exterior; match adjacent aluminum member finish.

5. Anchoring Devices: Corrosion resistant type capable of supporting entrance system and superimposed design loads; design to allow adjustments of system prior to being permanently fastened in place.

2.3 FABRICATION

A. Fabricate aluminum entrance and storefront system to allow for clearances and shim spacing around perimeter of assemblies to enable installation; provide for thermal movement.

B. Provide anchorage devices to securely and rigidly fit entrance assemblies in place.

C. Non-Automatic Doors: Comply with California Building Code and Americans with Disabilities Act (ADA) Standards relating to access for persons with disabilities.

1. Clear Opening Width: Minimum 32" clear opening width for each door.

D. Accurately fit together joints and corners; match components ensuring continuity of line and design; ensure joints and connections are flush, hairline and weatherproof.

E. Provide structural reinforcing within framing members where required to maintain rigidity and as required to accommodate design loads.

F. Allow moisture entering joints and condensation occurring within frame construction to drain to exterior.

G. Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, treatment, and application of coating.

H. Finishing: After fabrication, prepare surfaces for finishing in accordance with recommendations of aluminum producer and finish manufacturer.

I. Weld by methods recommended by metal manufacturer and AWS; grind exposed welds smooth and restore mechanical finish; remove arises from cut edges and corners to a radius of approximately 1/64".

J. Fit and assemble work at shop to greatest extent possible; disassemble only as required for shipment and erection.

K. Reinforce work as necessary for performance requirements and for support.

L. Provide internal reinforcing for hardware.

M. Separate dissimilar materials with bituminous paint or preformed separators which will prevent corrosion.

N. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts which permanently prevent "freeze-up" of joint.

O. Fabricate doors and apply hardware in shop. Disassemble only as required for transportation and installation.

P. Apply coat of bituminous paint or use comparable separator on concealed aluminum surfaces to be in contact with cementitious and with dissimilar materials.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install aluminum framed storefront assemblies, including entrances, in accordance with manufacturer's recommendations and installation instructions and to meet design criteria and performance criteria indicated, for weather-tight installation.

1. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

B. Ensure assemblies are plumb, level, and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.

1. Maximum Variation from Plane or Location: 1/8" in 12'-0", with maximum 1/2" variation in total length.

2. Maximum Offset Between Members: 1/16".

C. Use sufficient anchorage devices to secure and rigidly fasten assemblies to building.

D. Install hardware in accordance with manufacturer's recommendations, using proper templates.

1. Install doors to operate freely and smoothly, with a maximum operating pressure of 5 pounds in accordance with California Building Standards Code.

2. Coordinate installation of cylinders with Section 08 71 00 – Door Hardware.

3. Install sill members and thresholds in bed of compound, joint fillers, or gaskets to provide weathertight construction.

E. Glass Installation: Comply with GANA Glazing Manual and glazing manufacturer instructions.

1. Do not allow glass to touch metal surfaces.

3.2 CLEANING

A. Clean aluminum surfaces promptly after installation of components, exercising care to avoid damage of finish.

B. Mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.

C. Remove nonpermanent labels immediately after sealant cures and cure sealants for high early strength and durability.

3.3 PROTECTION

A. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged during construction period, including natural causes, accidents, and vandalism.

END OF SECTION

SECTION 08 44 20

GLAZED CURTAIN WALL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide factory finished unitized aluminum framed and structural sealant glazed curtain wall systems including glass, glazing materials, structural anchors, attachments, shims, and accessories for complete weather-tight installation.

1. Curtain wall systems include storefront systems, aluminum and glass entry door systems, reflective coating painted solar shelf integral with curtain wall system, and including glazing, hardware, and accessories.

B. Related Work:

1. Section 07 90 00: Perimeter sealants and back-up materials.
2. Section 08 35 40: Sliding aluminum and glass walls.
3. Section 08 71 00: Cylinders for door locks
4. Section 08 71 15: Low energy automatic door operators.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA): Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual.

B. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.

C. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

D. Definitions: National Association of Architectural Metal Manufacturers (NAAMM), Glossary of Architectural Metal Terms.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Design/Build: Provide special engineering for glazed curtain wall assemblies to ensure they comply with applicable codes and Contract Documents.

1. Project is based on standard systems with custom components and pieces as indicated. Design/Build requirements include certification that calculations have been completed indicating modifications comply with requirements specified.

B. Coordination: Coordinate methods for making junctures with adjacent surfaces watertight with Section 07 90 00 – Joint Sealants.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and product data for curtain wall system, glass, and major manufactured components.

B. Shop Drawings: Indicate pertinent dimensioning, clearances, general construction, anchorage locations, and typical details.

1. Include elevations at 1/4 scale, typical unit elevations at 1" scale and half or full-size detail sections of typical composite members.

2. Indicate joint systems, expansion provisions and glazing details.

C. Samples:

1. Aluminum: Where color range can be anticipated, submit two sets of range samples indicating anticipated variance in finish.

2. Glass: Submit each type specified except clear glass.

3. Frame: Submit corner construction indicating profile, size and joining method of a mullion and sill at a glass panel.

D. Test Reports: Submit laboratory reports of tests run on typical section of curtain wall system. Following to be considered minimum acceptable unless more stringent requirements are required by California Building Code or Title 24 Energy Code.

1. Test for Air Infiltration: ASTM E283 at 6.24-psf pressure difference.

2. Test for Water Penetration under Static Pressure: ASTM E331 using static air pressure difference of minimum 20% of inward acting design wind load pressure, but not less than 6.24-psf.

3. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.

4. Test for Structural Performance: ASTM E330. Minimum test loads shall be those specified.

a. Minimum ultimate loads shall be loads specified multiplied by factors of safety specified in California Building Code.

b. Measure deflections at member center lines and other critical points as deemed appropriate.

c. Safety Factor: Design for specified pressures with no glass breakage, no permanent damage to fasteners, and no permanent deformation of framing exceeding 0.2% of member clear span.

1) Glass safety factor relates to testing procedure, not occurrence of glass breakage in final installation.

E. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

1.5 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with requirements including those relative to energy efficiency.

B. Installer Qualifications: Firm acceptable to system manufacturer and with not less than five years successful experience installing systems of comparable type and size.

C. Mock-Up: Provide mock-up as indicated, as directed by Architect where not otherwise indicated; approved mock-up may be incorporated into Project.

1.6 WARRANTY

A. Extended Correction Period: Provide for correcting failure of system to resist damage from anticipated sources including damage from wind and water penetration.

1. Repair or replace units which fail in materials or workmanship.

a. Excessive air infiltration.
b. Excessive deflections.
c. Deterioration of finish and deterioration of metal.
d. Defects in weather-stripping.
e. Defects in glass.

2. Period: Two years.

B. Manufacturer’s Warranty: Submit manufacturer’s warranty including special manufacturer services as required for manufacturer’s warranty.

1. Period: 20 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner’s rights under implied and expressed warranties regardless of wording of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Oldcastle BuildingEnvelope.

B. Kawneer, an Arconic Company.

C. Arcadia, Inc.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide factory finished aluminum framed curtain wall systems including glass, glazing materials, structural anchors, attachments, shims, and accessories, and including storefronts, window walls, windows, and entry doors.

1. Basis of Design: Oldcastle BuildingEnvelope/Reliance -LT Curtain Wall Series 6000.

B. Regulatory Requirements: Comply with requirements of applicable codes.

1. Safety Glass: Comply with applicable building code, CPSC 16 CFR 1201, and pass ANSI Z97.1.

2. Accessibility: Provide for assuring access for persons with disabilities in accordance with state and federal regulations.

    a. California Regulations: Comply with California Building Standards Code.

    b. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.

3. Energy: Comply with California Energy Commission requirements regarding energy performance of curtain wall assemblies.

    a. Manufacturer shall be responsible for providing information required by authorities necessary to verify conformance.

    b. Entire assembly, including glass and glazing, shall be certified by National Fenestration Rating Council (NFRC) and shall bear NFRC Label indicating energy performance technical information.

C. Design Criteria: Provide complete system with joints, gaps, and penetrations made watertight.

D. Performance Criteria: Following are minimum requirements, California Building Code and Title 24 Energy Code may have greater requirements.

1. Deflections and Thermal Movements: Size primary members for deflection limitations and temperature variations as follows; fabricate, assemble, and erect work to maintain limitations.

    a. Normal-to-wall deflection of L/175 of span; except L/250 of span for glass supporting members.

    b. Parallel-to-wall deflection of less than 75% of glass edge clearances.

    c. Thermal expansion and contraction movements resulting from not less than ambient temperature range of 100 degrees F, which may cause a material temperature range of 160 degrees F.

2. Water and Air Leakage: Installed system shall be free of significant leakage of both water and air.

    a. Water leakage/penetration is defined as:

        1) Water inside exterior enclosure assembly that is neither contained nor positively drained back to exterior or,

        2) Infiltration of water through exterior enclosure assembly that can damage adjacent materials including wall, ceiling, and floor assembly components or to interior finishes.

3) Water contained within flashings and sills that is positively drained to exterior is not considered water leakage.

b. Water resistance is defined as no water leakage when measured in accordance with ASTM E331 with static test pressure of 8 psf.

c. Air leakage is defined as infiltration of air at any area of curtain wall, at a rate exceeding 0.06 cfm/sf of area, based on measurement of single complete module of system.

3. Condensation: Design system to prevent excessive condensation on indoor faces, with heating and ventilating system in operation, and under following conditions.

a. Outdoor: Ambient temperature 20-degrees F; 15-mph wind.

b. Indoor: Ambient temperature 75-degrees F; relative humidity of 25%.

c. Excessive Condensation: Visible water on more than 10% of interior exposed surface of any section, or accumulation or uncontrolled flow of water from condensation at any location.

E. Glazed Aluminum Framed Curtain wall Systems: Unitized and structural silicone glazed systems with custom elements based on profiles indicated on Drawings.

1. Aluminum Type: As recommended by manufacturer for application indicated, but not less than extruded aluminum, ASTM B221, alloy 6061 or 6063 and temper T5 or T6.

a. Provide thicknesses to comply with loading requirements.

2. Finish, High Performance Organic Coating: AA-C12C42R1x, prepared, pretreated, and coated with minimum three coat Kynar 500 or Hylar 5000 system; AAMA 2605.

a. PVDF Manufacturers:

1) Arkema Group/Kynar 500.
2) Solvay Solexis/Hylar 5000.
3) Substitutions: Refer to Section 01 25 00.

b. Paint Manufacturers:

1) PPG Industries.
2) Valspar Corp.
3) Akzo Nobel.
4) Substitutions: Refer to Section 01 25 00.

c. Color: Bright silver as required to match Architect’s samples.

F. Doors, Frames, and Hardware: Barrier-free entry doors meeting code requirements for providing access for people with physical disabilities; by entrance manufacturer.

1. Type: Side and top rails as indicated, 10" bottom rail unless greater dimension is indicated.

2. Metal and Finish: Match storefront and entrance system.

3. Hardware: Provide complete hardware system except as indicated; match curtain wall system finish unless otherwise directed by Architect. Coordinate with Section 08 71 00 – Door Hardware.

    a. Hinges: Extra heavy-duty ball bearing full mortise (butt) hinges complying with requirements specified in Section 08 71 00.

    b. Closers: Concealed adjustable type closer, maximum 5-pound operating pressure when installed in final application.

    c. Push/Pulls/Panic Devices: Types as indicated on Drawings; where not otherwise indicated manufacturer's standard types as selected by Architect; match finish of similar hardware as specified in Section 08 71 00.

    d. Security Locks: Manufacturer's standard.

        1) Cylinders: Provided under Section 08 71 00.

    e. Weather-Stripping, Sweep Strips: Manufacturer's recommended standard type, to suit application.

    f. Thresholds: Maximum 1/2" height above adjacent surfaces, with maximum 1/4" vertical section and remainder maximum 1:2 slope.

G. Glass: Provide minimum thicknesses specified, but no less than thicknesses required based on window size and configuration, anticipated wind loading, and Title 24 Energy Requirements.

1. Manufacturers:

    a. Vitro Architectural Glass (PPG).
    b. Guardian Industries Corp.
    c. Oldcastle Glass.
    d. Viracon.
    e. Substitutions: Refer to Section 01 25 00.

2. Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with minus 20-degree F dew point.

    a. Performance: Certified to ASTM E2190 by Insulating Glass Certification Council.

    b. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.

    c. Glass:

        1) Float Glass (Typical): Select glazing quality, clear float glass, ASTM C1036; minimum nominal thickness 1/4".

2) Tempered Glass (Where Indicated and Where Safety Glazing is Required): Select glazing quality, clear float glass, fully tempered, ASTM C1048; minimum nominal thickness 1/4"; safety glass.

3) Low Emissivity Coating: Provide high performance Low E coating on Number 2 surface, comparable to Vitro (PPG)/SolarBan 70 unless higher performance required for compliance with Title 24.

d. Total Unit Thickness: 1".

H. Glazing Materials: Of type recommended by system manufacturer to suit security locations and applications for glazing installation; designed to maintain glass in place and prevent movement.

1. Setting Blocks: Neoprene or EPDM, 80-90 Shore A durometer hardness; 4" long by 3/8" thick by 1/4" high; ASTM C864.

2. Spacer Shims: Neoprene or EPDM; 45-55 Shore A durometer hardness; 3" long by 3/32" thick by 1/4" high; ASTM C864.

3. Edge Blocks: Neoprene or EPDM, 60-70 Shore A durometer hardness; 4" long with minimum two per jamb located at top and bottom edges of glass; ASTM C864.

4. Glazing Gaskets: Exterior neoprene or EDPM; interior neoprene, EPDM or vinyl; miter corner joints at exterior applications; conform to ASTM C509 or C864.

5. Glazing Sealants: ASTM C920, Type S, Grade NS, elastomeric one-component silicone glazing sealants as recommended by sealant manufacture for application involved.

a. Manufacturers:

1) Dow Corning Corp.
2) General Electric Co.
3) Pecora Corp.
4) Tremco Inc.
5) Substitutions: Refer to Section 01 25 00.

b. Color: As indicated, as selected by Architect from manufacturer's full range of available colors where not otherwise indicated.

I. Miscellaneous Materials:

1. Fasteners: Aluminum or non-magnetic stainless steel of type which will not cause electrolytic action or corrosion.

a. Do not use exposed fasteners except where unavoidable for assembly or for application of hardware.

b. Indicate exposed fasteners on shop drawings for specific approval; exposed fasteners shall be Phillips flat-head screws or Allen screws with finish matching item fastened.

c. Provide concealed fasteners for glazing stops.

2. Steel Reinforcement and Brackets: Manufacturer's standard with minimum 2 oz. hot-dip zinc coating, ASTM A123, applied after fabrication.

3. Bituminous Paint: Cold-applied mastic, SSPC Paint 12, compounded for 30 mil thickness per coat.

4. Flashing: Provide sub-sill flashing members for fixed exterior framing; minimum 22-gage sheet aluminum of sizes and shapes indicated and required to drain water to exterior.

   a. Finish: Match adjacent aluminum primary members.

5. Anchoring Devices: Corrosion resistant type capable of supporting curtain wall system and superimposed design loads; design to allow adjustments of system prior to being permanently fastened in place.

2.3 FABRICATION

A. Fabricate systems to allow for adequate clearances around perimeter and to enable proper installation; allow for thermal movement within curtain wall construction.

B. Fabricate components allowing for accurate and rigid fit of joints and corners; match components carefully ensuring continuity of line and color, with joints and connections flush, hairline and weatherproof.

C. Provide structural reinforcing within framing members where required to maintain rigidity and as required to accommodate design loads.

D. Allow moisture entering joints and condensation occurring within framing members to drain to exterior.

   1. Design drainage system to hold maximum anticipated moisture for 100-year rain cycle without overflowing.

E. Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, treatment, and application of coating.

F. Finishing: After fabrication, prepare surfaces for finishing in accordance with recommendations of aluminum producer and finish manufacturer.

G. Weld by methods recommended by metal manufacturer and AWS; grind exposed welds smooth and restore mechanical finish; remove arises from cut edges and corners to a radius of approximately 1/64".

H. Fit and assemble work at shop to greatest extent possible; disassemble only as required for shipment and erection.

I. Reinforce work as necessary for performance requirements and for support.

   1. Provide internal reinforcing for hardware.

J. Separate dissimilar materials with bituminous paint or preformed separators which will prevent corrosion.

K. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts which permanently prevent "freeze-up" of joint.

L. Fabricate doors and apply hardware in shop. Disassemble only as required for transportation and installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install glazed aluminum curtain wall assemblies in accordance with manufacturer's recommendations and installation instructions, and to meet design criteria and performance criteria indicated, for weather-tight installation.

1. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

B. Ensure assembly is plumb, level, and free of warp or twist; maintain dimensional tolerances and alignment with adjacent work.

C. Tolerances: Accurately align and locate components to column lines and floor levels; adjust work to conform to following tolerances.

1. Plumb: 1/8" in 10'-0"; 1/4" in 40'-0"; non-cumulative.

2. Level: 1/8" in 20'-0"; 1/4" in 40'-0"; non-cumulative.

3. Alignment: Limit offset to 1/16" where surfaces are flush or less than 1/2" out of flush and separated by less than 2" (by reveal or protruding work); otherwise limit offsets to 1/8".

4. Location: 3/8" maximum deviation from measured theoretical location (any member, and location).

D. Install anchorage devices to secure and rigidly fasten system to building.

E. Provide anchors to be installed in other work, and setting details, in time for proper installation by trades concerned; verify correct placement.

F. Set sill members and similar members in bed of compound, joint fillers, or gaskets to provide weather-tight construction.

G. Install hardware in accordance with manufacturer's recommendations, using proper templates.

1. Install doors to operate freely and smoothly, with a maximum operating pressure of 5-pounds in accordance with California Building Code, Chapter 11B, Division III, Section 1133B2.5.

2. Coordinate installation of cylinders with Section 08 71 00 - Hardware.

3. Install sill members and thresholds in bed of compound, joint fillers, or gaskets to provide weather-tight construction.

H. Install glass in accordance with glass manufacturer's instructions and with GANA "Glazing Manual".

1. Do not allow glass to touch metal surfaces.

3.2 CLEANING

A. Clean aluminum surfaces promptly after installation of components, exercising care to avoid damage of finish.

B. Remove excess sealant compounds, dirt, and other foreign substances.

C. Mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.

D. Remove nonpermanent labels immediately after sealant cures, and cure sealants for high early strength and durability.

3.3 PROTECTION

A. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

F. California Building Code: Provide hardware that complies with CBC Section 11B.

1. All openings as a part of an accessible route shall comply with CBC Section 11B-404.

2. The clear opening width for a door shall be 32” minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34” and 4” maximum projections into it between 34” and 80” above the finish floor or ground. Door

closers and stops shall be permitted to be 78" minimum above the finish floor or ground. CBC Section 11B-404.2.3.

3. Operable hardware on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34" minimum and 44" maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.

4. Hardware (including panic hardware) shall not be provided with "nightlatch" function for any accessible doors or gates unless the following conditions are met:

   a. Such hardware has a 'dogging' feature and is dogged during the time the facility is open.
   b. All 'dogging' operation is performed only by employees as their job function (non-public use).

5. The force for pushing or pulling open a door shall be in accordance with CBC Section 11B-404.2.9.

   a. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (66.7N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
   b. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.
   c. The 5 pound (22.2 N) maximum force shall be validated for the size of the door used. The Building Materials Listing of the California State Fire Marshal shall indicate that the door hardware meets the 5 pound (22.2 N) force and shall also list the largest door that can be used.

6. Door closing speed shall comply with CBC Section 11B-404.2.8. Closers shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.

7. Floor stops shall not be located in the path of travel and 4" maximum from walls.

8. Thresholds shall comply with CBC Section 11B-404.2.5.

G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

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.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

    a. Hager Companies (HA) - BB Series, 5 knuckle.
    b. McKinney (MK) - TA/T4A Series, 5 knuckle.
    c. dormakaba Best (ST) - F/FBB Series, 5 knuckle.

2.3 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

6. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood (RO).
    c. Trimco (TC).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Restricted Keyway.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Where specified, provide status indicators with highly reflective color and wording for “locked/unlocked” or “vacant/occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1” x 0.6” with a curved design allowing a 180-degree viewing angle with protective covering to prevent tampering.

2. Manufacturers:

   a. Corbin Russwin Hardware (RU) - ML2000 Series.
   b. dormakaba Best (BE) - 45H Series.
   c. Sargent Manufacturing (SA) - 8200 Series.

B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.

1. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).

2. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

3. Locks are to be non-handed and fully field reversible.

4. Manufacturers:

a. Corbin Russwin Hardware (RU) - CLX3300 Series.
b. dormakaba Best (BE) - 9K Series.
c. Sargent Manufacturing (SA) - 10X Line.

2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    b. Sargent Manufacturing (SA) - 80 Series.
    c. dormakaba Best (PR) - Apex 2000 Series.

2.8 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible

to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

   a. Corbin Russwin Hardware (RU) - DC6000 Series.
   b. Norton Rixson (NO) - 7500 Series.
   c. Sargent Manufacturing (SA) - 351 Series.

2.9 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood (RO).
    c. Trimco (TC).

2.10 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood (RO).
    c. Trimco (TC).

2.11 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).
2. Reese Enterprises, Inc. (RE).

2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. 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 scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed,

operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. 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.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. SA - SARGENT
3. BE - BEST Access & Door Closers
4. RO - Rockwood
5. PE - Pemko

Hardware Sets

Set: 1.0

Doors: 101B, 104B, 113B, 115B

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Rim Exit Device	16 70 5CH AD8504 Less Pull	US32D	SA
1	Exit Device Deflector Kit	525	Blk	SA
2	Final Core	Best Patented - Match Std.		BE
1	Pull	RM201 Mtg-Type 12XHD	US32D	RO
1	Drop Plate	351D (as required)	EN	SA
1	Door Closer	351 P10	EN	SA
1	Door Stop	471 EXP	US26D	RO
1	Threshold	Per Detail & Field Conditions x FHSL14		PE
1	Gasket	By Door Manufacturer		
1	Sweep	315CN		PE

Set: 1.1

Doors: 101A, 116A

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Rim Exit Device	16 70 5CH AD8504 Less Pull	US32D	SA
1	Exit Device Deflector Kit	525	Blk	SA
2	Final Core	Best Patented - Match Std.		BE
1	Cylinder	As Required		OT
1	Pull	RM201 Mtg-Type 12XHD	US32D	RO
1	Automatic Opener	6331 / 6311	689	NO

1	Door Stop	471 EXP	US26D	RO
1	Threshold	Per Detail & Field Conditions x FHSL14		PE
1	Gasket	By Door Manufacturer		
1	Sweep	315CN		PE
4	Door Switch	671		NO
1	Keyswitch (auto operator)	MKA		SU

Notes: Exit device must be dogged for auto operator to function.

Set: 3.0

Doors: 117A

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Lockset	70 10XG38 LND	US26D	SA
2	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 CPS	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	471 EXP	US26D	RO
1	Threshold	Per Detail & Field Conditions x FHSL14		PE
1	Rain Guard	346C x Full Frame Width	Al	PE
1	Gasketing	294AV		PE
1	Sweep	90100CNB		PE
1	Sweep	315CN		PE

Set: 3.1

Doors: 116D

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Rim Exit Device	16 70 5CH 8804 FSW	US32D	SA
1	Exit Device Deflector Kit	525	Blk	SA
1	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 P10	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	471 EXP	US26D	RO
1	Threshold	Per Detail & Field Conditions x FHSL14		PE
1	Rain Guard	346C x Full Frame Width	Al	PE
1	Gasketing	294AV		PE

1	Sweep	90100CNB		PE
1	Sweep	315CN		PE

Set: 4.0

Doors: 104A

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	16 70 5CH AD8504 Less Pull	US32D	SA
1	Exit Device Deflector Kit	525	Blk	SA
2	Final Core	Best Patented - Match Std.		BE
1	Pull	RM201 Mtg-Type 12XHD	US32D	RO
1	Drop Plate	351D (as required)	EN	SA
1	Door Closer	351 CPS	EN	SA
1	Gasket	By Door Manufacturer		

Set: 5.0

Doors: 111

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	12 5CH 8806 ETND	US32D	SA
1	Exit Device Deflector Kit	525	Blk	SA
1	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 CPS	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Gasket	S44BL		PE

Set: 6.0

Doors: 113A, 115A

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device	12 5CH 8816 ETND	US32D	SA
1	Exit Device Deflector Kit	525	Blk	SA
1	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 P10	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasket	S44BL		PE

Set: 7.0

Doors: 110, 112

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom Lock	70 10XG04 LND	US26D	SA
1	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 O/P9	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 8.0

Doors: 106

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom Lock	70 10XG04 LND	US26D	SA
1	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 CPS	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
3	Silencer	608		RO

Set: 9.0

Doors: 102, 103

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office Lock	70 10XG24 LND	US26D	SA
1	Final Core	Best Patented - Match Std.		BE
1	Wall Stop	409	US32D	RO
1	Gasketing	S773BL		PE
1	Door Bottom	STC411APK		PE

Set: 10.0

Doors: 114A, 114B, 114C, 117B

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Classroom Lock	70 10XG37 LND	US26D	SA
1	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 O/P9	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasket	S44BL		PE

Set: 11.0

Doors: 105

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Classroom Lock	70 10XG37 LND	US26D	SA
1	Final Core	Best Patented - Match Std.		BE
1	Door Closer	351 O/P9	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 12.0

Doors: 109

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Privacy Lock	V21 8265 LNND	US26D	SA
1	Door Closer	351 O/P9	EN	SA
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Mop Plate	K1050 4" High CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 13.0

Doors: 107, 108

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Final Core	Best Patented - Match Std.		BE
1	Cylinder	As Required		OT
1	Push Plate	70C 4" x 16"	US32D	RO
1	Pull Plate	107x70C (3/4"x8")	US32D	RO
1	Automatic Opener	6331 / 6311	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Mop Plate	K1050 4" High CSK	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO
4	Door Switch	671		NO
1	Keyswitch (auto operator)	MKA		SU

Set: 14.0

Doors: 116B, 116C

1	All Hardware	By Door Manufacturer

END OF SECTION

SECTION 08 71 15

LOW ENERGY DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide low energy automatic door operators for swinging doors, with accessories as required for complete operational installation; system to open and close door upon receipt of an actuating signal.

B. Related Sections:

1. Section 08 44 10: Curtain wall and entrances, including standard hardware.
2. Division 26: Final electrical connections.

1.2 REFERENCES

A. ANSI A156.19: Power Assist and Low Energy Power Operated Doors Standard.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate low energy door operators with doors, frames, door hardware, and surrounding construction.

B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature and maintenance data.

B. Shop Drawings: Indicate pertinent dimensioning, general construction, materials and finishes, component connections, anchorage methods and locations and hardware; indicate exposed fasteners for specific approval.

1. Templates and Diagrams: Furnish templates, diagrams, and data necessary for proper installation of closers to fabricators of related work and coordinate.

C. Samples: Furnish samples of each exposed finish.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm with minimum five years successful experience installing door operator units like type specified and acceptable to operator manufacturer.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Horton Automatics/Series 7000.

B. LCN/4600 Series Electrically Powered Auto-Equalizer.

C. Dor-O-Matic, Inc./Senior-Swing Automatic Operation.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide low energy automatic door operators for swinging doors, with accessories.

B. Regulatory Requirements: Comply with applicable codes.

1. Power Failure: Doors shall not exceed 50-pounds force to set door in motion and shall not exceed 5 pounds force for pushing or pulling doors open when force applied to latch side of door.

C. Performance Criteria: Provide operators complying with applicable portions of ANSI A156.19, designed for doors of types indicated to receive operators.

D. System Description: Provide low energy automatic door operators for swinging doors, with accessories as required for complete operational installation; system to open and close door upon receipt of an actuating signal.

E. Low Energy Door Operators: Complete operator system including door operator, controls, and attachment system designed for type of doors indicated and complying with requirements of ANSI A156.19 for low energy power operated door operators.

F. Control: As indicated, as selected by Architect from manufacturer's full range of flush wall mounted push-button control units where not otherwise indicated.

1. Provide controls on each side of every door with an operator; number, size, type, and location as indicated and as required by California Building Standards Code to ensure access for persons with disabilities.

2.3 FABRICATION

A. Fabrication: Provide each automatic door operator as complete, shop fabricated unit.

1. Complete the fabrication, assembly, finishing, application of hardware and other work before shipment, to greatest extent possible.

2. Disassemble only to extent necessary of shipment and installation.

B. Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning and finishing. Remove arises from cut edges and ease edges and corners to radius of approximately 1/64".

C. Conceal fasteners unless otherwise approved by Architect.

D. Reinforce work as necessary for performance requirements, and for support to structure.

E. Separate dissimilar metals with bituminous paint or preformed separators to prevent corrosion; separate metal surfaces at moving joints with non-metallic separators to prevent "freeze-up" of joints.

F. Finish: Match entrance door finish as specified in Section 08 44 10 – Glazed Curtain Wall Systems.

G. Special Features:

1. Safety release clutch for obstructed closing and with checking for both opening and closing cycles.

2. Interlocks: Electrical interlocks which prevent operation of doors when locked or latched.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which automatic doors are to be installed; do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's recommendations and installation instructions for installation of low energy door operators.

B. Set plumb, level and true to line, without warp or rack of frames or doors; anchor securely in place.

1. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

C. Install complete door operator system including controls, control wiring and power units.

3.3 ADJUSTING

A. After operation of completed installation equivalent to three days use, readjust door operators and controls for optimum operating condition and safety.

B. Lubricate operating equipment.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide miscellaneous glass and glazing not provided elsewhere including accessories as required for complete installation.

a. Provide glazing for wood doors.

B. Related Sections:

1. Section 08 36 10: Sliding aluminum and glass wall glazing.
2. Section 08 44 10: Glazed window wall assemblies glazing.
3. Section 10 28 00: Metal framed mirrors.

1.2 REFERENCES

A. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.

1.3 SUBMITTALS

A. Product Data: Furnish for each type of glass and exposed glazing material.

B. Samples: Furnish samples of exposed glazing accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Section includes miscellaneous glass and glazing materials for items typically furnished without glazing and where glazing is not an integral part of the assembly.

B. Regulatory Requirements:

1. Safety Glass Standard: Comply with applicable codes, CPSC 16 CFR 1201, and pass ANSI Z97.1.

2. Fire Rated Glass: Provide glass identical to glass tested per ASTM E163, labeled, and listed by UL or other testing and inspection agency acceptable to applicable authorities.

C. Tempered Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.

1. Manufacturers:

a. Vitro Architectural Glass (formerly PPG).
b. Oldcastle Glazing.
c. Guardian Industries Corp.
d. Substitutions: Refer to Section 01 25 00.

2. Locations: Provide non-fire rated door openings as required by applicable codes and federal requirements.

D. Tempered Glass: Select glazing quality, low-iron clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass. Basis-Of-Design: Pilkington Optiwhite or equivalent products from other manufacturers.

1. Manufacturers:

a. Pilkington, NSG Group.
b. Vitro Architectural Glass (formerly PPG).
c. Oldcastle Glazing.
d. Guardian Industries Corp.
e. Substitutions: Refer to Section 01 25 00.

2. Locations: Provide at exterior doors and at window openings at the Vit Lab and Sensory Classrooms.

E. Clear Fire Rated, Impact Resistant Glass: Glazing quality, clear fire rated glass, polished both surfaces; nominal thickness 1/4”; UL listed clear fire rated glass; suitable for applications and fire ratings indicated on Drawings.

1. Manufacturers:

a. AGC InterEdge Technologies/Pyrobel.
b. Technical Glass Products/Pilkington Pyrodur and Pyrostop.
c. SAFTI First/SuperLite 20, SuperLite I XL, and SuperLite I XL IGU.
d. Substitutions: Refer to Section 01 25 00.

2. Glazing Materials: Type approved for use in applications indicated for required fire ratings; refer to fire label requirements.

3. Location: Provide at fire rated openings indicated to receive clear fire rated glass.

a. Hose Stream Test: Provide appropriate glazing for specific conditions indicated including but not limited to fire rated impact resistant glass required by applicable codes to pass hose stream test.

F. Spacer Shims: Silicone compatible, 50 durometer hardness; 3" long by 3/32" thick by 1/4" high.

G. Setting Blocks: 70-90 durometer hardness; 4” long by 3/8” thick by 1/4” high standard setting blocks.

H. Glazing Sealant: ASTM C920, Type S, Grade NS, elastomeric one-component silicone glazing sealants as recommended by sealant manufacturer for application involved.

1. Manufacturers:

a. Dow.
b. GE Momentive Performance Materials.
c. Pecora Corp.
d. Substitutions: Refer to Section 01 25 00.

2. Color: As selected by Architect from manufacturer's full range of available colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean glazing channels and framing members to receive glass immediately before glazing; remove coatings not firmly bonded to substrate.

B. Apply primer to joint surfaces where recommended by sealant manufacturer.

3.2 INSTALLATION

A. Comply with GANA Glazing Manual and Sealant Manual and glazing manufacturer recommendations and installation instructions.

1. Do not allow glass to touch metal surfaces.

2. Comply with applicable code requirements and NFPA 80 for glass in fire rated openings.

B. Place setting blocks at quarter points in thin course of sealant.

C. Install removable stops with glass centered in space with spacer shims at 2'-0" intervals on both sides of glass, 1/4" below sightline.

D. Sealant Glazing: Fill gap between glass and stops with sealant to depth equal to bite of frame on glass but not more than 3/8" below sightline.

1. Apply sealant to uniform and level line, flush with sightline; tool or wipe sealant surface for smooth appearance; at exterior locations tool sealant so water is carried away from glass.

3.3 CLEANING

A. At areas subject to potential impact mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.

B. Remove nonpermanent labels immediately after sealant cures and cure sealants for high early strength and durability.

C. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged during construction period, including natural causes, accidents, and vandalism.

END OF SECTION

SECTION 09 21 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide gypsum board systems including gypsum board, joint treatment, acoustical accessories, and general accessories for complete installation.

B. Related Sections:

1. Section 07 21 00: Building thermal insulation.
2. Section 07 84 00: Firestopping.
3. Section 09 30 00: Cementitious backer unit tile substrates.

1.2 REFERENCES

A. ASTM C840: Application and Finishing of Gypsum Board.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination, Openings: Obtain dimensions and locations from other trades and provide openings and enclosures for accessories, specialties, equipment, and ductwork.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for framing, insulation, gypsum board, and acoustical accessories.

B. Manufacturer’s Certification: Furnish manufacturer's certification indicating products comply with Contract Documents and applicable codes.

1.5 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

B. Level 4 Finish Mock-Up: Provide Level 4 finish mock-up not less than 100 square feet in location acceptable to Architect. Approved mock-up may be incorporated into Project.

1.6 SITE CONDITIONS

A. Do not begin installation of interior gypsum board until space is enclosed, space is not exposed to other sources of water, and space is free of standing water.

B. Maintain areas to receive gypsum board at minimum 50-degree F for 48 hours prior to application and continuously after application until drying of joint compound is complete; comply with ASTM C840.

C. Immediately remove from site gypsum board for interior use exposed to water, including gypsum board with water stains, with signs of mold, and gypsum board with mildew.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. National Gypsum Co.

B. Georgia-Pacific Corp.

C. United States Gypsum Co., USG Corp.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide gypsum board assemblies including gypsum board, joint treatment, acoustical accessories, and general accessories.

1. Systems Responsibility: Provide products manufactured by or recommended by manufacturer of gypsum board to maintain single-source responsibility for system.

B. Performance Requirements: Perform gypsum board systems work in accordance with recommendations of ASTM C840 unless otherwise specified.

C. Regulatory Requirements, Fire-Ratings: Provide systems listed in applicable code or by Underwriter's Laboratory, Gypsum Association (GA) File No's in GA-600 Fire Resistance Design Manual or other listing approved by applicable authorities.

D. Gypsum Board: Comply with ASTM C840; maximum permissible lengths; ends square cut, tapered edges on boards to be finished.

1. Typical: ASTM C1396, Type X, fire rated gypsum board, unless otherwise indicated.

2. Mold Resistant Gypsum Board: Provide at high humidity areas not covered with tile including but not limited to food prep, toilet rooms, and similar wet areas.

a. USG Industries/Sheetrock Mold Tough Firecode Core.
b. Georgia Pacific/ToughRock Mold-Guard Fireguard X.
c. National Gypsum Gold Bond XP Fire-Shield Gypsum Board.
d. Substitutions: Refer to Section 01 25 00.

3. Tile Substrates: Cementitious backer units specified in Section 09 30 00 - Tiling.

4. Cementitious Backer Units for FRP Walls: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL fire rated as required for fire rated assemblies.

a. Manufacturers:

1) National Gypsum Co./PermaBase Cement Board.
2) USG Industries, Durabond Division/Durock.
3) Custom Building Products/Wonderboard.
4) James Hardie Building Products/Hardibacker.
5) Substitutions: Refer to Section 01 25 00.

b. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.

E. Gypsum Board Accessories: Comply with ASTM C840.

1. Provide protective coated steel corner beads and edge trim; type designed to be concealed in finished construction by tape and joint compound.

2. Corner Beads: Manufacturer's standard metal beads.

3. Edge Trim: “J”, "L", "LK", or "LC" casing beads.

4. Reinforcing Tape, Joint Compound, Adhesive, Water, Fasteners: Types recommended by system manufacturer and conforming to ASTM C475.

a. Typical Joint Compound: Chemical hardening type for bedding and filling, ready-mixed or powder vinyl type for topping.

5. Control Joints: Back-to-back casing beads.

a. Back control joints with 4 mil thick polyethylene air seal.

F. Acoustical Accessories: Provide as indicated and as required to achieve acoustical ratings indicated.

1. Resilient Channels: Provide resilient channels where indicated and where required to provide required sound transmission classifications.

a. USG/RC-1.
b. ClarkDietrich/RC-Deluxe.
c. Substitutions: Refer to Section 01 25 00.

2. Acoustical Insulation: Preformed mineral fiber, ASTM C665, Type I; friction fit type without integral vapor barrier; as required to meet STC ratings indicated, or of thickness indicated.

3. Acoustical Sealant: ASTM C919, type recommended for use in conjunction with gypsum board. Paintable, non-shrinking and non-cracking where exposed, nondrying, nonskinning, nonstaining, and nonbleeding where concealed.

a. Acoustical Sealant Manufacturers:

1) USG/Sheetrock Acoustical Sealant.
2) Tremco/Acoustical Sealant.
3) Pecora/AC-20.
4) Substitutions: Refer to Section 01 25 00.

b. Fire Rated Acoustical Sealant at Penetrations in Fire Rated Assemblies: Provided in Section 07 84 00 – Firestopping.

4. Electrical Box Pads: Provide at outlet, switch and telephone boxes in walls with acoustical insulation.

a. Electrical Box Pad Manufacturers for Non-Fire Rated Partitions:

1) Harry A. Lowry & Associates (800.772.2521)/Lowry's Electrical Box Pads.
2) Tremco Sheet Caulking (650.572.1656).
3) Fire rated partition material manufacturers.
4) Substitutions: Refer to Section 01 25 00.

b. Electrical Box Pad Manufacturers for Fire Rated Partitions:

1) Hevi-Duty Nelson (800.331.7325)/Fire Rated FSP Firestop Putty Pads.
2) Specified Technologies, Inc. (800.992.1180)/Fire Putty Pads.
3) Hilti, Corp./Hilti Box Pads.
4) Substitutions: Refer to Section 01 25 00.

G. Fire Rated Assembly Accessories: Provide materials and accessories as required to comply with fire rating requirements of UL, GA or other listing approved by applicable authorities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Gypsum Board Installation: Install in accordance with ASTM C840 and manufacturer's recommendations.

1. Use screws when fastening gypsum board to furring and to framing.

2. Erect gypsum board with ends and edges occurring over firm bearing.

3. For fire rated systems comply with requirements for fire ratings.

4. Place control joints to be consistent with lines of building spaces and as directed by Architect.

a. Provide where system abuts structural elements.
b. Provide at dissimilar materials.
c. Lengths exceeding 30'-0" in partitions.
d. Ceiling areas exceeding 50'-0" or 2500 square feet.
e. Wings of "L", "U" and "T" shaped ceilings.

5. Place corner beads at external corners; use longest practical lengths.

6. Place edge trim where gypsum board abuts dissimilar materials.

7. Tape, fill, and sand exposed joints, edges, corners and openings to produce surface ready to receive finishes, feather coats onto adjoining surfaces.

8. Finishing: Comply with Gypsum Association (GA) “Levels of Gypsum Board Finish”.

a. GA Level 4 (Typical): Provide three-coat finishing and sanding is required for surfaces indicated to be painted; provide flush, smooth joints and surfaces ready for applied paint finishes.

9. Remove and replace defective work.

B. Acoustical Accessories Installation:

1. Install resilient channels in accordance with manufacturer recommendations and installation instructions for maximum acoustical performance.

2. Place acoustical insulation tight within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

3. Place acoustical sealant within partitions in accordance with manufacturer's recommendations; install acoustical sealant at gypsum board perimeter at:

   a. Metal Framing: One or two beads.
   b. Base layer and face layer.
   c. Penetrations of partitions.

4. Tolerance: Maximum 1/4" space between gypsum board at floor, ceiling, and penetrations and sealed with acoustical sealant.

5. Install electrical box pads with pads molded and pressed on back and all sides of box, closing openings, in accordance with manufacturer's instructions, for complete acoustical barrier.

END OF SECTION

SECTION 09 24 00

PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide three-coat integral color Portland cement plaster (stucco) with metal lath, and accessories as required for complete finished system.

B. Related Sections:

1. Section 07 25 00: Weather-resistive barrier underlayment.

1.2 REFERENCES

A. ASTM C926: Application of Portland Cement Based Plaster.

B. ASTM C1063: Installation of Lathing and Furring for Portland Cement Plaster.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product information for each lathing material and accessory, and for plaster materials.

B. Shop Drawings: Indicate locations of control and expansion joints not shown on Drawings.

C. Samples: Furnish 24” by 24” stucco samples using materials and methods specified including lath.

1.4 QUALITY ASSURANCE

A. Mock-Up: Provide not less than 100 sf mock-up of plaster; approved mock-up may be incorporated into Project.

1.5 SITE CONDITIONS

A. Take precautionary measures to ensure plaster is not subjected to excessive sun and wind which could cause uneven and excessive evaporation, premature dehydration, or cracking.

B. Cold-Weather Requirements: Do not apply plaster unless minimum ambient temperature of 40 degrees F has been and continues to be maintained for minimum 48 hours prior to application and until plaster is cured.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide integral color three coat (scratch, brown, and finish coats) Portland cement plaster (stucco) with metal lath and accessories.

B. Regulatory Requirements: Comply with applicable codes.

C. Portland Cement Plaster: Provide ready-mixed materials unless otherwise approved in writing by Architect, complying with ASTM C926.

1. Scratch and Brown Coat Materials:

a. Cement: Normal Type 1 or 1A Portland cement, ASTM C150.
b. Hydrated Lime: Special finishing hydrated lime, Type S, ASTM C206.
c. Aggregate: Natural sand, conforming to ASTM C897 or C144.

2. Brown Coat Water Acrylic Admix: Acrylic polymer specifically manufactured for use in Portland Cement Plaster (Stucco) applications, and which will not detrimentally affect finish.

a. Manufacturers:

1) Larsen Products Corp/Acrylic Admix 101.
2) BASF/Thoro Acryl 60.
3) Chem-Masters Corp/Cretelox.
4) Substitutions: Refer to Section 01 25 00.

3. Proprietary Integral Color Finishing Materials: Provide proprietary Portland cement-based factory mixed integral color finishing materials as indicated and as approved by Architect.

a. Manufacturers:

1) La Habra Products, Inc.
2) Merlex Stucco, Inc.
3) Omega Products Corp.
4) Substitutions: Refer to Section 01 25 00.

4. Water: Clean, fresh, and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

D. Metal Components: Comply with requirements of ASTM C1063.

1. Manufacturers:

a. Phillips Manufacturing Company
b. Alabama Metal Industries Corp (AMICO).
c. ClarkDietrich Building Systems.
d. Substitutions: Refer to Section 01 25 00.

2. Exterior Components: Hot-dip galvanized finish; ASTM A924 and A653 minimum G90 for 18-gage and lighter formed metal products, ASTM A123 galvanized after fabrication for 16-gage and heavier products.

a. Exposed Exterior Components: Zinc accessories unless fully concealed in plaster.

3. Exterior Metal Lath: Galvanized expanded diamond mesh; minimum 2.5-psy.

    a. Backing: Weather resistive barrier system specified in Section 07 25 00 – Weather-Resistive Barrier.

    b. Self-Furring: Where over solid substrate, provide “V” groove type to hold lath approximately 1/4" from supporting base.

    c. Tie Wire: ASTM A641, soft temper, Class 1 zinc coated; minimum 16-gage for tying metal lath to furring channels and metal lath to metal lath.

4. Inside Corner Mesh: Minimum 26-gage steel; perforated or expanded flanges or clips shaped to permit complete embedding in plaster; minimum 2" by 2" size.

E. Accessories: Provide as indicated, as recommended by referenced standards, and as required for complete installation.

1. Manufacturers:

    a. Keene Products from Metalex, a Division of The Koller Group.
    b. Delta Star, Inc., Superior Metal Trim.
    c. California Expanded Metals (CEMCO).
    d. Brand X Metals.
    e. Lath manufacturers.
    f. Substitutions: Refer to Section 01 25 00.

2. Corner Beads, Casing Beads, and Base Screeds: Minimum 26-gage, square edges at casing beads, drip type base screeds; provide with expanded flanges.

3. Expansion Joints: Two-piece slip type joints; commonly referred to as No. 40.

4. Control Joints: One-piece metal joint designed to interlock with plaster like Keene/XJ15-3.

F. Anchorages: Tie wire, nails, screws, and other approved metal supports, of type and size to suit application.

1. Staples not permitted.

2.2 PLASTER MIXES

A. Provide plaster mixes in accordance with ASTM C926 as appropriate to the substrate indicated and the approved samples.

B. Mix only as much plaster as can be used in one hour.

C. Mix materials dry, to uniform color and consistency, before adding water.

D. Protect mixes from frost, dust, and evaporation.

E. Do not retemper mixes after initial set has occurred.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to application ensure mechanical and electrical services behind surfaces to receive cement plaster have been tested and approved.

B. Ensure framing is installed properly and rigidly secured.

3.2 INSTALLATION

A. Erect furring and lath in accordance with ASTM C1063.

B. Install work true to lines and levels and to provide surface flatness with maximum variation of 1/8" in 10'-0" in any direction.

C. Isolation: Isolate lathing and metal support system where it abuts building structure horizontally, and where partition/wall work abuts overhead structure, to prevent transfer of building loads into plaster.

1. Install slip or cushion type joints to absorb deflections but maintain lateral support.

D. Frame both sides of expansion joints independently unless otherwise indicated, do not bridge joints with furring and lathing or accessories.

E. Fixture Support Framing: Install supplementary framing, blocking, and bracing where work is indicated to support fixtures, equipment, services, and similar work requiring attachment and support.

F. Coordinate installation of anchors, blocking, electrical and mechanical work which is to be placed in or behind framing; allow such items to be installed after framing is complete.

G. Install expansion and control joints so plaster areas do not exceed 120-sf, and with area sides having a maximum one to two and a half (1:2-1/2) ratio, unless otherwise approved by Architect.

H. Metal Lathing: Apply lath taut, with long dimension perpendicular to supports; secure end laps with tie wire where they occur between supports; lap ends minimum 1" and sides 1/2”; secure with tie wires.

1. Continuously reinforce internal angles.

2. Place 6" wide x 12" long strips of metal lath diagonally at corners of openings; secure rigidly in place.

3. Place 6" wide strips of metal lath at junctions of dissimilar materials; place parallel with dissimilar materials; secure rigidly in place.

I. Installation of Metal Accessories:

1. Fasten in place true to line and in correct relation to adjacent materials and as required to prevent dislodging and misalignment by subsequent operations.

2. Fasten at both ends and at maximum 12" on center along sides.

3. Bring grounding edge of accessories to true lines, plumb, level, and straight.

4. Install accessories to provide required depth of plaster and to bring plaster surface to required plane.

5. Install continuous corner reinforcement for full length external corners.

6. Install sill and drip screeds with paper sheathing and lath installed over attachment flange of screeds.

7. Beads: Use single length metal beads wherever length of run does not exceed longest standard stock length available; miter or cope corners.

    a. Provide casing beads where plaster abuts dissimilar construction and at perimeter of openings where edges of plaster will not be concealed by other work.

J. Portland Cement Plaster: Conform to ASTM C926.

1. Stucco: Apply three coat cement plaster system, scratch, brown, and finish coats.

2. Apply each base coat (scratch and brown) to minimum thickness of 3/8"; allow each coat to moist cure for minimum period of 48 hours.

    a. Moist cure first base coat (scratch coat) during 48-hour period.

3. Allow base coats to cure for minimum 7 days prior to application of finish coat.

4. Evenly dampen base coat, to ensure uniform suction, and apply finish coat; apply thickness sufficient to secure required texture but in no case less than 1/8".

    a. Apply pre-mixed finish coat in accordance with manufacturer's recommendations.

5. Maintain surface flatness, with maximum variation of 1/8" in 10'-0".

6. Avoid excessive working of surface, delay troweling to avoid drawing excess fines to surface.

K. Proprietary Integral Color Finish: Comply with manufacturer recommendations and application instructions. Provide surfaces with finish to match approved sample panel and mock-up.

3.3 CUTTING AND PATCHING

A. Cut, patch, point, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections.

B. Repair or replace work to eliminate blisters, buckles, crazing, check cracking, dry-outs, efflorescence, sweat-outs, and similar defects.

C. Finish cutting and patching to match undamaged plaster; patching shall not be visible in finished installation.

3.4 CLEANING

A. Promptly remove plaster from surfaces not indicated to be plastered.

B. Repair surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide tile installations with accessories, as required for complete installation.

1. Provide waterproofing/crack isolation membrane integral with tile setting beds.
2. Provide cementitious backer unit tile substrate.

B. Related Sections:

1. Section 09 21 00: Gypsum board including backer units for FRP wall panels.

1.2 REFERENCES

A. ANSI A108.5: Installation of Tile with Latex-Portland Cement Mortar.

B. ANSI A108.10: Installation of Grout in Tilework.

C. ANSI A108.11: Interior Installation of Cementitious Backer Units.

D. Tile Council of North America (TCNA): Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of material for Project.

B. Samples: Furnish each type of tile clearly indicating pattern, coloration, and joints.

1. Color Charts: Submit actual tile sections showing full range of colors, textures, and patterns available for each type of tile.

2. Prepare two 12" square sample panels of each selected type of tile and grout.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

1.5 SITE CONDITIONS

A. Provide heat and ventilation in areas where ceramic tile work is being performed, to allow tile to properly set.

B. Take precautionary measures necessary to ensure excessive temperature changes do not occur.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide tile installations with tile, grout, setting materials, and accessories as indicated.

B. Regulatory Requirements, Slip-Resistance: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and access for persons with disabilities.

C. Tile: Types as indicated which could include ceramic, ceramic mosaic, quarry, paver, porcelain, stone, and glass type tiles.

1. Manufacturers:

a. Dal-Tile Corp.
b. Crossville Tile.
c. Summitville Tiles, Inc.
d. Manufacturers listed on Finish Schedule.
e. Substitutions: Refer to Section 01 25 00.

2. Color, Style, and Pattern: As indicated on Finish Schedule, as selected by Architect from manufacturer’s full range of types of tiles indicated where not otherwise indicated.

a. Match Architect approved samples.

3. Base and Trim: Provide matching trim pieces, coordinated with sizes and coursing of adjoining flat tile as directed by Architect; types as indicated, as selected by Architect where not indicated.

D. Latex Thin Set: Thinset bond coat, consisting of latex-cementitious mortar conforming to ANSI A118.4.

1. Manufacturers:

a. Laticrete International Inc.
b. Bostik Construction Products/Hydroment.
c. Custom Building Products.
d. Mapei Corp.
e. Merkrete.
f. Substitutions: Refer to Section 01 25 00.

E. Latex-Cement Grout: ANSI A118.7, latex-cementitious type, uniform in color, resistant to shrinkage.

1. Manufacturers:

a. Laticrete International Inc.
b. Bostik Construction Products/Hydroment.
c. Custom Building Products.
d. Mapei Corp.
e. Merkrete.
f. Substitutions: Refer to Section 01 25 00.

2. Color: Match tile unless otherwise indicated.

F. Waterproofing/Crack Isolation Membrane: Manufacturer's standard liquid rubber polymer designed specifically for application under tile in non-immersed applications.

1. Manufacturers:

a. Laticrete International Inc./9235 Waterproof Membrane.
b. Bostik Construction Products/Hydroment Ultra-Set.
c. Custom Building Products/RedGard Membrane.
d. Merkrete/Hydro-Guard SP-1.
e. The Nobel Company/NobelSeal TS.
f. Substitutions: Refer to Section 01 25 00.

G. Cementitious Backer Units: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; approximately 1/2" thick; UL fire rated as required to maintain integrity of fire rated assemblies.

1. Manufacturers:

a. USG Industries, Durabond Division/Durock.
b. National Gypsum Co./PermaBase Cement Board.
c. Custom Building Products/Wonderboard.
d. Substitutions: Refer to Section 01 25 00.

2. Contractor Option Coated Glass Mat Backer Units: Georgia Pacific/DenShield, UL fire rated as required to maintain integrity of fire rated assemblies.

H. Cleaning and Sealing Materials: As recommended by tile and grout manufacturers but not less than following.

1. Manufactures:

a. Laticrete International Inc./Stonetech.
b. Bostik Construction Products/Hydroment CeramaSeal.
c. Substitutions: Refer to Section 01 25 00.

I. Accessories: Provide as indicated and as required for complete tile installation for applications indicated.

1. Special Tile Trim Pieces: Provide as indicated on Drawings.

a. Manufacturers:

1) Schluter Systems L.P.
2) Blanke Corp.
3) Ceramic Tool Company, Inc.
4) Substitutions: Refer to Section 01 25 00.

2.1 MIXES

A. Mix and proportion cementitious materials for site-made leveling coats, setting beds and grout as recommended by the TCNA Handbook for Ceramic Tile Installation.

B. Mix and proportion pre-mixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installing tile, ensure surfaces are level; comply with TCNA and tile manufacturer recommendations but not greater than following.

1. Thin Set Tile Tolerance: Maximum surface variation of 1/8" in 10'-0".

B. Ensure surfaces are clean and well cured.

C. Do not commence work until surface conditions are within tolerances required for proper installation; apply latex leveling material where necessary to meet required tolerances.

D. Waterproof/Crack Isolation Membrane: Install membrane at tile areas located above grade, in accordance with manufacturer's recommendations; extend membrane minimum 6" up walls.

1. Comply with membrane manufacturer recommendations for installation of tile over waterproof membrane.

E. Backer Units: Install units in accordance with ANSI A108.11, manufacturer's recommendations, and as required to provide fire ratings indicated on Drawings.

3.2 INSTALLATION

A. Install tile in accordance with manufacturer recommendations and installation instructions, referenced ANSI Standards, and TCNA recommendations for type of substrate and indicated setting method.

1. Complexity of TCNA variations in types of tile installation systems and potential for changes to surrounding conditions during design and construction makes exact listing of potential conditions improbable.

2. Contractor, installers, and manufacturer representatives shall inform Architect where actual conditions are not covered and where providing similar materials and systems do not comply with TCNA or manufacturer recommendations.

a. Where specified or similar materials and systems do not comply with TCNA or manufacturer recommendations submit proposed substitutions along with statement substitutions are of comparable quality to specified materials.

B. Following systems shall form the basis of tile installation systems required for Project. Where Project conditions vary from TCNA and manufacturer recommendations, notify Architect immediately. Where different use similar materials and systems as appropriate.

1. Latex-Cement Thin Set Floors over Waterproof and Crack Isolation Membrane: TCNA F122.

2. Latex-Cement Thin Set Wall Tile over Cementitious Backer Units: TCNA W244.

3. Latex-Cement Thin Set Wall Tile over Coated Glass Mat Backer Units: TCNA W245.

C. Place tile in accordance with patterns indicated on Drawings or as directed by Architect; carefully plan tile layouts, ensure pattern is uninterrupted from one surface to the next and through doorways.

1. Apply latex thin set to back of tile where necessary to ensure 100% bond between bond coat and substrate; replace tiles which break due to voids between tile and substrate.

D. Place stone thresholds level and true to line; in correct alignment with tile, doors, and partitions.

E. Neatly cut tile around fixtures and drains; accurately form corners, base, intersections and returns.

1. Base, Coves: Flush cove type with base grout joint on wall, cove tile on floor, unless otherwise indicated.

2. Corners and Edges: Bullnose tile unless otherwise indicated.

F. Locate expansion joints, control joints, contraction joints, and isolation joints where indicated; where not indicated, provide as recommended by TCNA Handbook and as approved by Architect.

1. Install special trim pieces as indicated on Drawings and in accordance with manufacturer recommendations and installation instructions, true to lines and levels indicated and in correct relationship with tile and adjacent materials.

G. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size; ensure joints are watertight, without voids, cracks, excess mortar, or grout.

H. Sound tile after setting, remove and replace hollow sounding units.

I. Allow tile to set for a minimum 48 hours prior to grouting.

J. Grout tile to comply with recommendations of TCNA and as specified.

K. Leave completed installation free of broken, damaged, and faulty tile.

3.2 CLEANING AND SEALING

A. Clean tile surfaces free of foreign matter upon completion of grouting.

B. Seal tile and grout surfaces when recommended by manufacturer for materials and applications involved; comply with manufacturer's recommendations.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide suspended acoustical ceiling system with exposed suspended metal grid system, trim, and accessories as required for complete finished installation.

B. Related Sections:

1. Divisions 21 through 28: Facilities services for ceiling penetrations.

1.2 REFERENCES

A. ASTM C635: Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636: Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM E580: Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of acoustical ceiling systems with items installed above ceilings to ensure work above ceilings is complete, ceiling space allows for concealed items while allowing required ceiling heights, and building is enclosed.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturers' literature.

B. Shop Drawings: Clearly indicate grid layout and related dimensioning, junctions with other work and ceiling finishes, and inter-relation of mechanical and electrical items related to system.

C. Samples: Furnish samples of exposed grid finish and each type of ceiling unit.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm with minimum five years successful experience in projects of similar type and scope; acceptable to manufacturer of integrated acoustical ceiling system.

1.6 SITE CONDITIONS

A. Do not install ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead mechanical work is completed, tested and approved.

1. Do not allow acoustical ceiling units to be exposed to moisture; immediately remove acoustical ceiling units with stains, units with signs of mold, and units with mildew.

B. Allow wet work to dry prior to commencement of installation.

C. Maintain uniform temperatures of minimum 60 degrees F and humidity of 20% to 40% prior to, during and after installation.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Armstrong World Industries, Inc.

B. CertainTeed.

C. Rockfon North America, Chicago Metallic Corp.

D. USG Corporation.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide acoustical ceiling systems with exposed suspended metal grid system, trim, and accessories as required for complete finished installation.

B. Regulatory Requirements, Seismic Design: Comply with California Building Code requirements for seismic bracing of ceiling suspension system, and with ASTM E580.

1. Ceiling Struts: Provide struts as detailed on Drawings and as required by code, placed maximum 8'-0" on center in both directions and within 6'-0" of each wall.

2. Slack Wires: Provide safety slack wires, two per fluorescent fixture on diagonally opposite corners and a single wire for each recessed down light.

C. Regulatory Requirements; Fire Performance Characteristics: Provide products listed by Underwriters Laboratories (UL) or other independent testing laboratory acceptable to authorities having jurisdiction.

1. ASTM E84: Provide products meeting code requirements for maximum 25 flame spread and maximum 450 smoke developed.

D. Suspension Systems: Comply with ASTM C635, as applicable to type of suspension system required for type of ceiling units indicated.

1. Exposed Grid System: Narrow 9/16" nominal face width, direct hung, aluminum or steel "T" exposed grid system.

2. Attachment Devices: Size for 5 times design load indicated in ASTM C635, Table 1, Direct Hung.

3. Hanger Wires: Galvanized carbon steel, ASTM A641, soft temper, pre-stretched, yield-stress load of at least three times design load, but not less than 12-gage.

4. Straps, Tubes and Angles: Provide galvanized steel as required to meet state and local requirements for seismic design loads.

5. Structural Class: Minimum intermediate-duty system.

6. Edge Molding: Manufacturer's standard angle molding for edges and penetrations of ceiling, with single flange of molding exposed.

7. Finish of Exposed Items: Manufacturer's standard white baked enamel.

8. Maximum Allowable Deflection: L/360.

E. Acoustical Panels: ASTM E1264 type and form as indicated on Finish Schedule, as selected by Architect from manufacturer’s full range of panels where not otherwise indicated.

1. Basis of Design: Armstrong lay-in ceiling panels with tegular (reveal) edge designed to be compatible with specified suspension system.

2. Texture: Light fissured panels unless otherwise indicated on Drawings.

3. Size: 2'-0" by 2'-0", except where otherwise indicated on Drawings.

4. Finish: Standard washable white painted finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Furnish layouts for inserts, clips and other supports required to be installed by other trades for support of acoustical ceilings.

1. Install inserts, clips, and supports where not previously installed and where additional supports are required for complete installation.

B. Measure ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling; do not use less than half width units at borders.

C. Coordinate with other work supported by or penetrating through ceilings, including integral air handling systems, light fixtures, and other systems.

3.2 INSTALLATION

A. Install acoustical ceiling systems in accordance with manufacturer's recommendations and ASTM C636.

1. Coordinate installation of air handling systems and electrical systems integral with integrated acoustic ceiling systems.

2. Finished Ceilings: True to lines and levels and free from warped, soiled, or damaged grid or acoustical units.

B. Install ceiling systems in a manner capable of supporting superimposed loads, with maximum permissible deflection of 1/8" in 10'-0".

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

1. Ensure suspension system is located to accommodate fittings and units of equipment which is to be placed after installation of ceiling grid.

D. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers, and related carrying channels as required to span required distance.

E. Install ceiling suspension system to resist seismic loads as required by state and local codes, including extra hanger wires and compression supports for ceilings and light fixtures.

F. Hang system independently of walls, columns, ducts, pipes, and conduit. Where suspension system members are spliced, avoid visible displacement of the longitudinal axis or face plane of adjacent members.

G. Do not support lighting fixtures from or on main runners or cross runners if weight of fixture causes total dead load to exceed deflection capability.

1. Support fixture loads independently or provide supplementary hangers located within 6" of each corner.

H. Do not install fixtures so main runners and cross runners are eccentrically loaded; where fixture installation would produce rotation of runners, provide stabilizer bars.

I. Install edge moldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level. Miter corners.

1. Provide edge moldings at junctions with other ceiling finishes.

J. Where required form expansion joints to accommodate movement and maintain visual closure without distorting system.

K. Fit acoustic units in place, free from damaged edges or defects detrimental to appearance and function.

1. Lay directionally patterned units one way with pattern as directed.
2. Fit border units neatly against abutting surfaces.

L. Install system level, in uniform plane and free from twist, warp, and dents.

M. Install hold-down clips where required by applicable codes and where ceiling is within 20'-0" of an exterior door.

3.3 ADJUSTING

A. Adjustment: Adjust sags or twists which develop in ceiling system and replace any part which is damaged or faulty.

END OF SECTION

SECTION 09 65 10

RESILIENT BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide resilient base and accessories as required for complete finished installation.

1. Provide floor to wall stainless-steel cove base trim.

B. Related Sections:

1. Section 09 30 00: Special metal transitions at tile.
2. Section 09 65 20: Resilient tile flooring.
3. Section 09 65 25: Static resistant flooring.
4. Section 09 68 10: Carpet tile edge strips.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's product literature.

B. Samples: Furnish samples of each base color and type.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives and resilient flooring.

1.4 SITE CONDITIONS

A. Comply with manufacturer recommendations for site conditions but not less than following; maintain minimum 70-degree F air temperature at installation area for three days prior to, during, and for 24 hours after installation.

B. Store materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Johnsonite, Inc.

B. Mannington Commercial, Burke Base.

C. Roppe Rubber Corporation.

D. Armstrong World Industries.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide resilient base and accessories as required for complete finished installation.

B. Performance Requirements: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/sq. cm or higher.

C. Resilient Base: Conform to ASTM F1861, with premolded end stops and external corners; 1/8" gage; provide coved base at hard floor surfaces, straight base at carpet unless otherwise indicated.

1. Type: Extruded rubber, in rolls.

2. Height: 4" unless otherwise indicated.

3. Color: As indicated on Finish Schedule, as selected by Architect from manufacturer's full range of available colors where not otherwise indicated.

D. Primers and Adhesives: Water-resistant nontoxic types recommended by base manufacturer for specified material and application.

E. Special Stainless-Steel Cove Base: Schluter/Dilex-HKS as approved by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Apply to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required.

1. Fit base joints tight and vertical.

2. Maintain minimum measurement of 18" between joints.

B. Miter internal corners; use molded sections for external corners and exposed ends.

C. Install on solid backing, adhere tightly to wall and floor surfaces and fill voids along top edge of base with manufacturer's recommended adhesive filler.

D. Scribe and fit to door frames and other obstructions.

E. Install straight and level to variation of plus or minus 1/8" over 10'-0".

3.2 CLEAN-UP

A. Remove excess adhesive from floor, base, and wall surfaces without causing damage.

B. Clean surfaces in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 09 65 20

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide resilient tile flooring and accessories as required for complete finished installation.

B. Related Sections:

1. Section 09 65 10: Resilient base.
2. Section 09 65 25: Static resistant flooring.
3. Section 09 68 10: Carpet tile edge strips.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's product literature.

B. Samples: Furnish samples of each type of flooring color and pattern.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives and resilient flooring.

1.4 SITE CONDITIONS

A. Ensure floor surfaces are smooth and flat with maximum variation of 1/8" in 10'-0".

B. Ensure concrete floors are dry and exhibit negative alkalinity, carbonizing, and dusting.

C. Maintain minimum 70-degree F air temperature at flooring installation area for three days prior to, during, and for 24 hours after installation.

D. Store flooring materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 MATERIALS

A. System Description: Provide resilient tile flooring and accessories.

B. Regulatory Requirements, Flammability: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/sq cm or higher.

C. Regulatory Requirements, Slip-Resistance: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and for access for persons with disabilities.

D. Resilient Rubber Tile: 610mm by 610mm by 3mm thick; nora vulcanized rubber compound 913.

1. Manufacturers:

a. Basis of Design: nora systems, Inc.
b. Burke Mercer.
c. Johnsonite, Inc.
d. Flexco Flooring.
e. Substitutions: Refer to Section 01 25 00.

2. Color and Pattern: As indicated on Finish Schedule, as selected by Architect from manufacturer's full range of available colors where not otherwise indicated.

E. Edge Strips: Homogeneous vinyl or rubber, tapered or bullnose edge, color as selected by Architect.

F. Sub-Floor Filler: White premixed latex-cement paste designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes.

1. Use material capable of being applied and feathered out to adjacent floor without spalling.

G. Primers and Adhesives: Waterproof nontoxic types as recommended by flooring manufacturer for specified material and application.

H. Sealer: Type recommended by flooring manufacturer for material type and location.

PART 3 - EXECUTION

3.1 PREPARATION

A. Conform to manufacturer's recommendations for preparation and to ASTM F710.

B. Remove sub-floor ridges and bumps; fill low spots, cracks, joints, holes, and defects with sub-floor filler.

C. Clean floor and apply, trowel and float filler to leave smooth, flat hard surface; prohibit traffic until filler is cured.

D. Test substrate for moisture content in accordance with flooring manufacturer recommendations; where moisture content exceeds recommendations take measures recommended by flooring manufacturer.

3.2 INSTALLATION

A. Conform to manufacturer recommendations and installation instructions.

1. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.

B. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.

C. Set flooring in place using methods to ensure full adhesion.

D. Lay flooring with joints parallel to building lines to produce symmetrical pattern.

E. Install minimum 1/2 tile at room and area perimeter.

F. Terminate resilient flooring at centerline of door openings where adjacent floor finish is dissimilar.

G. Install edge strips at unprotected and exposed edges.

H. Scribe flooring to walls, columns, floor outlets and other appurtenances, to produce tight joints.

I. Consult with Architect for floor pattern desired in each area.

J. Edge Strips: Install where edge of tile would otherwise be exposed; butt to flooring without gaps; set in adhesive.

3.3 CLEAN-UP AND PROTECTION

A. Remove excess adhesive from floor, base, and wall surfaces without causing damage.

B. Clean and seal floor surfaces in accordance with manufacturer's recommendations.

C. Prohibit traffic from floor for 48 hours after installation.

END OF SECTION

SECTION 09 65 25

STATIC RESISTANT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide static resistant (conductive) resilient tile flooring and accessories as required for complete finished installation.

B. Related Sections:

1. Section 09 65 10: Resilient base.
2. Section 09 65 20: Resilient tile flooring.
3. Section 09 68 10: Tile carpeting edge strips.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's product literature including information regarding static resistance (conductivity).

B. Samples: Furnish samples of each type of flooring color and pattern.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives and resilient flooring.

1.4 SITE CONDITIONS

A. Ensure floor surfaces are smooth and flat.

B. Ensure concrete floors are dry and exhibit negative alkalinity, carbonizing, and dusting.

C. Maintain minimum 70-degree F air temperature at flooring installation area for three days prior to, during, and for 24 hours after installation.

D. Store flooring materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Armstrong Flooring/Static Dissipative Excelon SDT.

B. VPI Corporation/ESD Static Control Tile.

C. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide static resistant resilient tile flooring and accessories.

B. Regulatory Requirements, Flammability: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/sq cm or higher.

C. Regulatory Requirements, Slip-Resistance: Hard surface finishes to comply with requirements of authorities having jurisdiction for slip-resistant hard surfaces, including general code requirements and access for persons with disabilities.

D. Performance Criteria, Conductivity (Static Resistance): Meet UL Standard 779, Standard for Electricity Conductive Flooring.

E. Static Resistant Vinyl Composition Tile (VCT): 12" by 12" by 1/8" thick; vinyl composition tile conforming to ASTM F1066, Composition 1.

1. Color and Pattern: As indicated on Finish Schedule as selected by Architect from manufacturer's full range of available colors where not otherwise indicated.

2. Static Dissipative Flooring: Provide conductive type tile flooring designed to conduct static charges to grounding cables preventing static buildup. Provide accessories as required for complete static dissipative flooring system.

F. Edge Strips: Homogeneous vinyl or rubber, tapered or bullnose edge, color as selected by Architect.

G. Sub-Floor Filler: White premixed latex-cement paste designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes.

1. Use material capable of being applied and feathered out to adjacent floor without spalling.

H. Primers and Adhesives: Waterproof nontoxic types as recommended by flooring manufacturer for specified material and application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Conform to manufacturer's recommendations for preparation and to ASTM F710.

B. Remove sub-floor ridges and bumps; fill low spots, cracks, joints, holes, and defects with sub-floor filler.

C. Clean floor and apply, trowel and float filler to leave smooth, flat hard surface; prohibit traffic until filler is cured.

D. Test substrate for moisture content in accordance with flooring manufacturer recommendations; where moisture content exceeds recommendations take measures recommended by flooring manufacturer.

3.2 INSTALLATION

A. Conform to manufacturer recommendations and installation instructions including special instructions to ensure static resistance (conductivity) of flooring installation.

   1. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.

B. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.

C. Set flooring in place using methods to ensure full adhesion.

D. Lay flooring with joints parallel to building lines to produce symmetrical pattern.

E. Install minimum 1/2 tile at room and area perimeter.

F. Terminate resilient flooring at centerline of door openings where adjacent floor finish is dissimilar.

G. Install edge strips at unprotected and exposed edges where flooring terminates.

H. Scribe flooring to walls, columns, floor outlets and other appurtenances, to produce tight joints.

I. Consult with Architect for floor pattern desired in each area.

J. Edge Strips: Install where edge of tile would otherwise be exposed; butt to flooring without gaps; set in adhesive.

3.3 CLEAN-UP AND PROTECTION

A. Remove excess adhesive from floor, base, and wall surfaces without causing damage.

B. Prohibit traffic from floor for 48 hours after installation.

END OF SECTION

SECTION 09 68 10

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide carpet tile including edge strips where carpeting terminates at other floor finishes and accessories as required for complete finished installation.

1.2 SUBMITTALS

A. Product Data: Prior to final acceptance of carpet tile installation, submit manufacturer's detailed maintenance recommendations for care, cleaning and repair of carpet tiles installed.

B. Shop Drawings: Clearly indicate carpet tile layout, direction of carpet tiles, adhesive to be used, method of integrating edge strips with carpet tile, and installation procedures.

C. Samples: Submit samples of each carpet tile type and color, and of each color of edge strip.

D. Certificate of Compliance: Furnish manufacturer's certificate of compliance stating each material delivered conforms to Specifications.

E. Maintenance Recommendations: Prior to final acceptance of carpet tile installation, furnish carpet tile manufacturer's detailed maintenance recommendations for care, cleaning and repair of carpet tiles installed.

F. Maintenance Materials: Submit unused carpet tiles. Box unused carpet tiles and mark boxes indicating color and location installed.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for carpet systems and adhesives.

B. Installer Qualifications: Firm with minimum five years successful experience in carpet tile installation and approved by carpet tile manufacturer.

1. Upon request, submit letter from carpet manufacturer stating installer is acceptable.

C. Mock-Up: Provide minimum 12' by 12' mock-up of carpet tile for approval prior to beginning installation; approved mock-up may be incorporated into finished installation.

1.4 SITE CONDITIONS

A. Do not commence carpet tile installation until painting and finishing work is complete and ceiling and other overhead work has been tested, approved and completed, unless specifically approved.

B. Maintain room temperature at minimum 60 degrees F for at least 24 hours prior to installation; relative humidity shall be approximately that at which area is to be maintained.

C. Schedule, receive, and place carpet tile on floors indicated; protect from soiling and damage during transit, storage, and installation.

1.5 WARRANTY

A. Extended Correction Period: Provide for promptly making good or replacing defective materials or workmanship. Repairs shall take place within ten days of written notification.

1. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Interface Flooring Systems, Inc.

B. Lees Carpets, Division of Burlington, Inc.

C. Shaw Commercial Carpets.

D. Manufacturers listed on Finish Schedule.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide carpet tile including edge strips where carpeting terminates at other floor finishes and accessories.

B. Regulatory Requirements: Carpet tiles shall have passed following fire and smoke tests.

1. DOC-FF-1-70: Pass.
2. ASTM E662 (Smoke Denveloped): 450 or less.
3. ASTM E648 or NFPA 253 (Flooring Radiant Panel Test): 0.45 or higher.

C. Design Criteria: Provide carpet materials that bear Carpet and Rug Institute “Green Label Plus”.

D. Performance Requirements, Static: Carpet tile shall develop less than 3.0 kilovolts of static at 70 degrees F and 20 percent relative humidity.

E. Carpet Tile: Types as indicated on Finish Schedule; where carpet tile is not indicated provide as directed by Architect based on following criteria.

1. Yarn: 6.6 or later generation continuous filament soil hiding nylon.

2. Face Weight: Minimum 30 oz. per square yard.

3. Tile Size: As indicated, as selected by Architect from manufacturer's full range of carpet tile sizes where not indicated.

4. Pile Height: Maximum 1/2".

5. Backing: Integrated polyurethane cushion; no latex backing permitted.

6. Antimicrobial Treatment: Provide to inhibit growth of bacteria, mold, and mildew.

7. Soil-Resistant Treatment: Manufacturer's standard integral stain resistance.

8. Colors and Patterns: As indicated on Finish Schedule, as selected by Architect from manufacturer's full range of colors and patterns where not otherwise indicated.

F. Adhesive: Nontoxic type recommended by carpet tile manufacturer to suit application and expected service.

G. Leveling and Ramping Material: Latex-cement material designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes.

1. Use material capable of being applied and feathered out to adjacent floor without spalling.

H. Edge Strips: Vinyl or rubber; manufacturer's standard colors as selected.

I. Accessories: Provide as required for complete finished installation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean floors of dust, dirt, solvents, oil, grease, paint, and other substances detrimental to proper performance of adhesive and carpet tile; allow floors to thoroughly dry.

B. Ensure floors are level, with maximum surface variation of 1/4" in 10 feet.

C. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity.

D. Use leveling and ramping material to patch cracks, small holes, leveling and for ramping to provide finished carpet tile within 1/2" of adjacent flooring materials.

E. Test substrate for moisture content in accordance with flooring manufacturer recommendations; where moisture content exceeds recommendations take measures recommended by flooring manufacturer.

3.2 INSTALLATION

A. Install carpet tiles in accordance with manufacturer's recommendations and installation instructions.

1. Adhere tiles to subfloor unless otherwise approved.

B. Prime substrate if required and as recommended by manufacturer. Spread adhesive in quantity recommended by manufacturer to ensure proper adhesion. Apply only enough adhesive to permit proper adhesion of carpet tile before initial set.

C. Lay carpet tile with run of pile in direction of anticipated traffic; do not change run of pile in any one room or from one room to next where continuous through a wall opening.

1. Finished installation to provide monolithic carpet tile appearance as approved by Architect.

D. Cut and fit carpet tile neatly around projections through floor and to walls and other vertical surfaces.

E. Fit carpet tiles snugly to walls or other vertical surfaces, leaving no gaps.

F. Lay installation tight and flat to subfloor well fastened and uniform in appearance; ensure monolithic color, pattern and texture match within any one area.

G. Edging Strips: Install in accordance with manufacturer recommendations and installation instructions.

1. Install edging strips where carpet terminates at other floor coverings.

2. Use full length pieces only, butt tight to vertical surfaces. Where splicing cannot be avoided, butt ends tight and flush.

H. Do not place heavy objects such as furniture on carpet tiled surfaces for not less than 24 hours or until adhesive is set.

3.3 CLEANING

A. Upon completion of carpet tile installation in each area, visually inspect carpet tile installed in that area and immediately remove dirt, soil and foreign substance from exposed face.

B. Clean in accordance with manufacturer's recommendations.

C. Inspect adjacent surfaces and remove marks and stains caused by carpet tile installation.

D. Remove packaging materials, carpet tile scraps, and other debris from carpet tile installation.

END OF SECTION

SECTION 09 77 30

FIBERGLASS WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide glass fiber reinforced polyester (FRP) resin fabricated wall panels with trim pieces and accessories as required for complete installation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

B. Scheduling: Schedule installation of wall paneling as late in construction schedule as possible to prevent damage during construction.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature including recommendations for cleaning.

B. Shop Drawings: Show detailing including panel configuration, anchorage, accessories, anchors, treatment of joints, penetrations, and exposed edges.

C. Samples: Furnish fiberglass wall panels and exposed trim.

D. Maintenance Instructions: Include manufacturer's recommended cleaning materials and application methods, including precautions in use of cleaning materials that may be detrimental to surfaces.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to pollution control for adhesives.

B. Fabricator Qualifications: Firm with minimum five years successful experience fabricating metal items like those required for Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store panels in clean and dry area where temperatures are maintained at minimum 40-degrees F with normal humidity.

1. Do not store in upright position.

B. Take precautionary measures with adhesives and solvents to prevent fire hazards.

1.6 SITE CONDITIONS

A. Maintain surfaces and materials at minimum 60-degrees F three days before and during application period.

B. Provide continuous ventilation during work and after installation of wall covering.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Crane Composites/Glasbord.

B. Nudo Products, Inc./Fiber-Lite Panels or Marlite FRP Panels.

C. Stabilit America/Glasteel FRP Liner Panel.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide glass fiber reinforced polyester resin fabricated wall panels, with trim pieces and accessories.

B. Regulatory Requirements:

1. Fire-Rating: Class III (UL Class C), maximum 200 flame-spread, 450 smoke developed, ASTM E84.

2. Wet Wall Applications: Provide system acceptable by applicable authorities for use on walls in wet locations such as Janitor Closets.

C. Panels: Fiberglass reinforced plastic (FRP) panel system acceptable for use as toilet room wall panels, adjacent to water closets and to urinals; ASTM D5319.

1. Thickness: 0.090" nominal thickness.

2. Antibacterial, Mold, and Mildew: Provide panels with integral antibacterial additive and which are mold and mildew resistant.

3. Surface: As selected by Architect from manufacturer's full range of surface textures.

4. Color and Texture: As selected by Architect from manufacturer’s full range of colors and textures.

D. Trim Pieces: Manufacturer's standard matching moldings and trim pieces as required for complete, finished installation, and as required for joints, corners, and panel edges; suitable for applications indicated.

1. Color: Match panels.

E. Adhesive: Nontoxic type recommended by wall covering manufacturer to suit application and complying with applicable limitations for volatile organic compound (VOC) emissions.

F. Primer: Provide non-staining nontoxic release coat primer as recommended by wall panel manufacturer where panels are applied to gypsum board.

1. Primer: Type designed to allow removal of wall paneling from gypsum board without damaging paper facing of board, and without premature separation of wall paneling from wall.

G. Fasteners: Concealed type only; types as recommended by system manufacturer.

H. Accessories: As indicated, as recommended by system manufacturer, and as required for complete finished installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure surfaces to receive wall paneling are clean, true, and free of irregularities, do not commence with work until surfaces are satisfactory.

B. Ensure wall surface flatness tolerance does not vary more than 1/8" in 10'-0", nor vary at a rate greater than 1/16" per running foot.

3.2 INSTALLATION

A. Handle and install wall panels in accordance with manufacturer's recommendations and installation instructions.

B. Cope and miter trim pieces.

C. Securely adhere panels to wall surfaces; use blind nailing methods as required to support panels until adhesive dries; exposed mechanical fasteners shall not be acceptable.

1. Install panels in maximum size increments available.

D. Remove excess adhesive from edges and wipe seam clean with dry cloth towel.

E. Install wall paneling before installation of plumbing, bases, hardware, and similar accessories.

3.3 CLEANING

A. Clean panel system in accordance with manufacturer's instructions.

B. Remove debris and leave areas neat and clean.

C. Replace accessories.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.

1. Specified surface preparation, priming and coats of paint are in addition to shop-priming and surface treatment specified under other sections of work.

2. Painting and finishing include field finishing of exterior and interior items not listed as "Surfaces not to be Painted" unless clearly indicated otherwise.

3. Painting and finishing include field finishing of select shop finished items such as mechanical grilles and registers and shop primed items such as access panels and louvers in doors, to match adjacent surfaces.

a. Match adjacent surfaces in color and sheen unless otherwise indicated.

4. Field paint exposed bare and covered pipes, ducts, and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work in occupied spaces.

5. Wood Doors: Contractor option to factory finish or field finish, coordinate with Section 08 14 00 - Wood Doors.

B. Surfaces Not to be Painted:

1. Finished items including finished metal surfaces.
2. Walls and ceilings in concealed areas and generally inaccessible areas.
3. Moving parts of operating mechanical and electrical units.
4. Labels: Keep equipment identification and fire rating labels free of paint.
5. Plastic smoke stops and weather-stripping at doors.

C. Related Sections: Shop priming of ferrous metal items is included under various Specification sections.

1. Section 06 40 00: Shop finishing of architectural woodwork.
2. Section 09 96 70: High performance coating for exterior steel columns.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material.

B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.

1. Brush-Outs: Submit samples of each color and material with texture to simulate actual conditions, on hardboard.

a. Submit 8" by 10" samples of wood finishes on actual wood surfaces; label and identify each as to location and application.

2. Field Samples: Duplicate painted finishes of approved samples on actual wall surfaces and components for approval prior to commencing work.

a. Size: Minimum 100 sf located where approved.
b. Components: One full component as directed.
c. Simulate finished lighting conditions for review.

C. Manufacturer Certificates: Furnish certificates from each manufacturer stating materials are top quality lines and suitable for intended use on this Project.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for paints and coatings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in original, new, and unopened packages and containers bearing manufacturer's name and label, with:

1. Name of material, color, and sheen.
2. Manufacturer's name, stock number and date of manufacture.
3. Contents by volume, for major pigment and vehicle constituents.
4. Thinning and application instructions.

1.5 SITE CONDITIONS

A. Apply water-base paints when temperature of surfaces and surrounding air are between 50 and 90-degrees F.

B. Do not apply paint in rain, fog, or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.

C. Painting may be continued during inclement weather if areas to be painted are enclosed and heated within temperature limits specified.

D. Provide additional temporary ventilation during interior application of paints to eliminate volatile organic compound (VOC) emissions from interior spaces as quickly as possible.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Basis of Design: Sherwin-Williams Co.

B. Benjamin Moore & Co.

C. PPG Industries.

D. Dunn-Edwards Corp.

E. Kelly Moore Paint Co.

F. Vista Paint Co.

G. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.

1. Definition: "Painting" and “coating” as used herein means systems including primers, emulsions, enamels, stains, sealers, and fillers, whether used as prime, intermediate or finish coats.

B. Regulatory Requirements:

1. Volatile Organic Compound (VOC) Emissions: Furnish materials approved for use by applicable air quality management district for limitations of volatile organic compounds for architectural or special coatings as applicable.

C. Material Quality: Provide top line quality commercial grade (professional painter) paints; materials not bearing manufacturer's identification as their top line product shall not be acceptable.

1. Primers: Provide premium grade primers recommended by paint manufacturer for substrates indicated and for finish systems specified.

2. Undercoats and Barrier Coats: Provide undercoat paints produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer and use only within recommended limits.

3. Finish Coats: Provide finish coats capable of being washed with mild detergent without loss of color, sheen, or pigments.

a. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.

4. Finish Coat Coordination: Provide finish coats which are compatible with prime paints, undercoats, and barrier coats used.

a. Review other Specification sections in which prime paints are provided; ensure compatibility of total coatings systems.

b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.

c. Provide barrier coats over incompatible primers or remove and prime as required.

d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

D. Colors and Finishes: Prior to commencement of painting work, Architect will furnish color chips for surfaces to be painted.

1. Use of proprietary names in color selection is not intended to imply exclusion of equivalent products of other manufacturers.

2. Final acceptance of colors will be from samples applied on site.

3. Colors: As indicated on Finish Schedules, as directed by Architect where not otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Examine areas and conditions under which painting work is to be applied.

1. Start of painting work indicates acceptance of surfaces and conditions of surfaces and conditions within any area.

2. Where exposed items or surfaces are not specifically mentioned in Schedules, paint same as adjacent similar materials or areas.

3. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable paint film.

B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.

C. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting; after painting reinstall removed items.

D. Clean surfaces before applying paint; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.

E. Wood: Clean wood surfaces of dirt, oil, and other foreign substances; sandpaper smooth surfaces exposed to view and dust off.

1. Scrape and clean seasoned knots and apply thin coat of recommended knot sealer, before application of priming coat.

2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job; prime edges, ends, faces, undersides, and backsides of wood.

3. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler and sandpaper smooth when dry.

F. Ferrous Metals: Touch up shop-applied prime coats wherever damaged using same type of primer as applied in shop or barrier coat compatible with finish paint.

1. Bare Surfaces: Clean surfaces that are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum-based solvent; primer and touch-up primer to be zinc-rich primer.

G. Mix painting materials in accordance with manufacturer's directions.

H. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

I. Stir materials before application to produce mixture of uniform density and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 APPLICATION

A. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.

1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color, and appearance.

2. Provide extra attention during application to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.

3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces; paint surfaces behind permanently fixed equipment and furniture with prime coat only.

4. Finish doors on tops, bottoms, and side edges same as faces.

5. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

7. Sand lightly between coats when recommended by system manufacturer.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation.

1. Allow time between successive coatings to permit proper drying.

2. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.

D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.

E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections.

1. Opaque Finishes: Provide opaque, uniform finish, color, and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.

2. Transparent and Stained Finishes: Produce glass smooth surface film of even luster; provide with no cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, and other surface imperfections.

F. Completed Work: Match approved samples for color, texture, and coverage; remove, refinish, or repaint work not accepted.

3.3 PAINTING SCHEDULE

A. Exterior Work: Provide following paint systems and sheens unless otherwise indicated.

1. Metal (Typical): Semigloss sheen.

a. 1st Coat: Touch-up primer, prime if none.
b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.

2. Metal Columns: High-performance coating specified in Section 09 96 70.

3. Natural Finish Wood: Flat sheen.

a. 1st Coat: Exterior clear penetrating wood sealer and preservative.

B. Interior Work: Provide following paint systems and sheens unless otherwise indicated.

1. Gypsum Board Systems: Eggshell (satin) sheen at walls, flat sheen at ceilings, semigloss sheen at toilet rooms, and as indicated.

a. 1st Coat: Universal primer.
b. 2nd and 3rd Coat: Interior latex or acrylic latex emulsion.

2. Metal: Semigloss sheen.

a. 1st Coat: Touch-up primer, prime if none.
b. 2nd and 3rd Coat: 100% acrylic enamel.

3. Opaque Finished Wood: Semigloss sheen.

a. 1st Coat: Primer undercoat.
b. 2nd and 3rd Coat: 100% acrylic enamel.

4. Stained Wood: Satin rubbed sheen.

    a. 1st Coat: Wood stain.
    b. 2nd Coat: Sanding sealer.
    c. 3rd and 4th Coat: Acrylic modified urethane.
    d. Fill open grained wood with filler and wipe before 2nd coat.

5. Transparent Finished Wood: Satin rubbed sheen.

    a. 1st Coat: Bleached shellac.
    b. 2nd and 3rd Coat: Acrylic modified urethane rubbing varnish.
    c. Fill open grained wood with filler and wipe before 1st coat.

C. Sheens: Comply with ASTM D523, reflectance of paint.

1. Flat: 1-10.
2. Satin: 15-30.
3. Eggshell: 30-45.
4. Semigloss: 45-75.
5. Gloss: 75-100.

3.4 CLEAN-UP, PROTECTION, AND REPAIR

A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each workday.

1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing, or replacing, and repainting, as acceptable to Architect.

1. Provide "Wet Paint" signs to protect newly painted finishes.

2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

END OF SECTION

SECTION 09 96 70

HIGH-PERFORMANCE COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide high-performance coating system of urethane over epoxy primer as indicated, including surface preparation, priming and high-performance coating application.

1. Location: Provide high-performance coating at exterior steel columns. Coordinate priming with architecturally exposed structural steel specifications.

B. Related Work:

1. Section 09 90 00: Standard painting and coating systems.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical information, including coating label analysis and application instructions for each material.

B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.

1. Provide samples of each color and material with texture to simulate actual conditions.

C. Certificates: Provide certificate from each manufacturer stating material is top quality line and suitable for intended use on this Project.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for paints and coatings.

B. Installer Qualifications: Minimum of five years successful experience in application of high-performance coating systems of type specified and acceptable to manufacturer of coating system.

C. Mock-Up: Duplicate finish of approved samples in field at location as approved by Architect, one complete component or approximately 100 square feet, for approval prior to commencing work.

1. Approved mock-up may be incorporated into Project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in original, new, and unopened packages and containers bearing manufacturer's name and label, with:

1. Name of material, color, and sheen.
2. Manufacturer's name, stock number and date of manufacture.

3. Contents by volume, for major pigment and vehicle constituents.
4. Thinning and application instructions.

1.5 SITE CONDITIONS

A. Apply high performance coating when temperature of surfaces and surrounding air are between manufacturer recommended temperatures.

B. Do not apply high performance coating in rain, fog, or mist; or when relative humidity exceeds 85-percent; or to damp or wet surfaces.

1.6 WARRANTY

A. Extended Correction Period: Provide for correcting failure of high-performance coating including peeling, chipping, rusting of substrate, cracking, delamination, chalking, and loss of color and sheen.

1. Period: Two years.

B. Manufacturer’s Warranty: Submit manufacturer’s warranty including special manufacturer services as required for manufacturer’s warranty.

1. Period: 10 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner’s rights under implied and expressed warranties regardless of wording of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. DuPont Co. Maintenance Finishes.

B. Tnemec Company, Inc.

C. PPG Protective & Marine Coatings.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide high performance coating system of urethane over epoxy primer as indicated, including surface preparation, priming and high-performance coating application.

B. Regulatory Requirements, Volatile Organic Compound (VOC) Emissions: Provide materials complying with applicable air quality management requirements for volatile organic compound (VOC) emissions limitations.

C. Special Coating: High build acrylic polyurethane or aliphatic polyurethane over compatible epoxy primer as recommended by coating manufacturer and suitable for applications indicated and based on quality of following products.

1. Systems:

   a. DuPont/Imron with 25P primer.
   b. Tnemec/Endura-Shield II (Series 1075) with Series V69 epoxy primer.
   c. PPG/AmerShield VOC with Amerlock 2-400 primer.
   d. Substitutions: Refer to Section 01 25 00.

2. Special Coating System: Provide specific primer and coating as recommended by manufacturer for applications indicated, conforming to specified requirements.

   a. 1st Coat: Epoxy primer.

   b. 2nd and 3rd Coat: High-build acrylic polyurethane or high-build polyurethane.

3. System Requirements:

   a. Abrasion: ASTM D4060, CS-17 Wheel, 1,000 grams load, no more than 95 mg. loss after 1000 cycles.

   b. Adhesion: ASTM D3359 Method B (Crosshatch Adhesion), coating applied to sandblasted steel and cured 30 days at 77° F, minimum rating of 5 on average of three tests.

   c. Humidity: ASTM D4585, no blistering, cracking, or delamination of film after 1000 hours exposure.

   d. Salt Spray (Fog): ASTM B117, no blistering, rusting, cracking, or delamination of film; maximum 1/8" rust creepage at scribe after 1000 hours exposure.

   e. UV: ASTM G154, no blistering, cracking, or chalking, less than 35% gloss loss and less than 3.5 MacAdam unit color change after 1500 hours exposure.

4. Coordination: Provide special coating system compatible with prime paints, undercoats, and barrier coats used.

   a. Review other Specification sections in which prime paints and zinc-rich touch-coatings up are provided; ensure compatibility of total coatings systems.

   b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.

   c. Provide barrier coats over incompatible primers or remove and reprime as required. Reprime with zinc-rich primer where galvanized.

   d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

D. Colors and Finishes:

1. Prior to commencement of coating work, Architect will furnish color chips for surfaces to be coated; custom colors may be required.

2. Final acceptance of colors will be from samples applied on site.

3. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.

4. Sheen: Gloss; comply with ASTM D523, reflectance of coating, 75-100.

E. Material Quality: Provide primers produced by same manufacturer as finish coats; use only thinners approved by coating manufacturer and use only within recommended limits.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Examine areas and conditions under which high performance coating work is to be applied.

1. Start of high-performance coating work indicates acceptance of surfaces and conditions of surfaces and conditions within any area.

2. Do not apply coating over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable coating.

B. Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions and as specified for substrate condition.

C. Remove items in place and not to be coated or provide protection prior to application of high-performance coating; after application of coating reinstall removed items.

D. Clean surfaces before applying high-performance coating; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly coated surfaces.

E. Metal Preparation: Comply with coating manufacturer recommendations, but not less than following requirements.

1. Bare Surfaces: Clean surfaces which are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum-based solvent.

3. Painted Surfaces: Clean surfaces of loose paint, dirt, and foreign substances by mechanical cleaning; feather edges of existing paint to provide smooth, even substrate for high performance coating.

F. Mix materials in accordance with manufacturer's directions.

G. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of coating in a clean condition, free of foreign materials and residue.

H. Stir materials before application to produce mixture of uniform density and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 APPLICATION

A. Apply high performance coating in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and coating material being applied.

1. Apply additional coats when stains or blemishes show through final coat, until coating is a uniform finish, color and appearance.

2. Provide extra attention to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.

B. Scheduling: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for high performance coating as soon as practicable after preparation.

1. Allow time between successive coatings to permit proper drying.

2. Do not recoat until coating feels firm and does not deform or feel sticky under moderate thumb pressure.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.

D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.

E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections; edges clean and sharp where work joins other materials and colors.

1. Provide opaque, uniform finish, color, and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.

F. Completed Work: Match approved samples and mock-up for color, texture, and coverage. Remove, refinish, or recoat work not accepted.

3.3 CLEAN-UP, PROTECTION AND REPAIR

A. Clean-Up: During progress of work, remove discarded coating materials, rubbish, cans and rags from site at end of each workday.

1. Clean glass and coating-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

B. Protection: Protect work of other trades, whether to be coated or not; correct damage by cleaning, repairing or replacing, and refinishing, as acceptable to Architect.

1. Provide "Wet Coating" or "Wet Paint" signs to protect newly coated surfaces.

2. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.

C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces and defaced coated surfaces.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide general signage as indicated complete with attachment devices and accessories as required for complete installation.

B. Related Sections:

1. Section 10 44 00: Fire extinguisher cabinet graphics.
2. Division 26: Photoluminescent exit signs.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature and indicate each sign type, style, color, and method of attachment.

B. Shop Drawings: Furnish listing of sign types, lettering, and locations, along with dimensions of each sign.

1. Computerized Output: Furnish computerized samples of signs and graphics at full scale duplicating final appearance.

2. Dimensional Letter Signs: Furnish complete shop drawings regarding fabrication and method of attachment of dimension letter signs.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. ASI Modulex, ASI Sign Systems, Inc.

B. Mohawk Sign Systems.

C. Vomar Products, Inc.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide signage as indicated with attachment devices and accessories.

B. Regulatory Requirements: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.

1. California Regulations: Comply with California Building Code.

2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.

C. Dimensional Raised Cast Letter and Donor Signage: Provide signs as indicated.

1. Aluminum: Manufacturer's standard for individual letter signs.

a. Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.

2. Fabrication: Fabricate as indicated, of minimum 0.25" casting with edges and corners smooth and finished to match adjacent metal finishes.

3. Attachment: Secure using connections concealed after installation; method subject to Architect approval.

a. Take care back welding does not damage exposed sign surfaces.

D. Halo-Lit Signage: Provide signs as indicated with channel letters and LED illumination, for stand-off installation; suitable for applications and locations indicated.

1. Aluminum: Manufacturer's standard for individual letter signs.

a. Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.

2. Fabrication: Fabricate dimensional letters as indicated, of minimum 0.25" aluminum with edges and corners smooth and finished to match adjacent metal finishes.

3. Attachment: Secure using connections for stand-off installation; method subject to Architect approval.

a. Take care back welding does not damage exposed sign surfaces.

b. Coordinate with electrical work.

E. Toilet Room Door Signs: Provide door signs conforming to California requirements for signs for toilet rooms; concealed mounting system.

1. Material, Plastic: Manufacturer’s standard colored plastic/photopolymer signs; color as indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

a. Texture: Smooth.

2. Total Thickness: 0.25".

3. Provide signs required by California Code of Regulations Title 24.

   a. Men's Room: 12" equilateral triangle, vertex pointing up.

   b. Ladies' Room: 12" diameter circle.

   c. Gender Neutral Room: 12" diameter circle with equilateral triangle, vertex pointing up, superimposed on the circle; circle and triangle each 0.25" thick.

      1) Color of triangle shall contrast with color of circle which shall contrast with color of door face.

4. Colors: As selected to contrast with doors.

5. Symbols: As selected from manufacturer's standard symbols.

6. Adhesive: Type as recommended by sign manufacturer for type of substrate involved.

F. Toilet Room Wall Signs: Provide signs conforming to California Building Code and ADA Standards for signs for permanent rooms, with inset symbols and with raised and Braille characters; concealed mounting system.

1. Material, Plastic: Manufacturer’s standard colored plastic/photopolymer signs; color as indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

   a. Texture: Smooth.

2. Comply with California Building Code and ADA Standards for raised and Braille characters, pictorial symbols, finish, and contrasts requirements.

G. Tactile Exit Door Signs: Provide colored plastic/photopolymer signs, conforming to California Building Code Section 1013.4 and ADA Standards for signs for permanent rooms, with tactile raised and Braille characters; concealed mounting system.

1. Colors: As selected by Architect.

2. Size and Style: As indicated on Drawings.

H. Room Identification and Direction Signs: Provide signs conforming to California and ADA Standards for permanent signs, total thickness 0.125"; provide raised and Braille characters conforming to California and ADA Standards; concealed mounting.

1. Material, Plastic: Manufacturer’s standard colored plastic/photopolymer signs; color as indicated, as selected by Architect from manufacturer’s full range of colors where not otherwise indicated.

   a. Texture: Smooth.

2. Sizes and Styles: As indicated on Drawings, as directed by Architect where not otherwise indicated.

I. Emergency Evacuation Signs: Silk-screened or photopolymer polycarbonate with graphics on back. Provide with tactile and Braille information conforming to California requirements and ADA Standards where required.

1. Information: Provide sign system with information as required by applicable authorities for emergency egress.

2. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink.

a. Silk-Screen Colors: As selected by Architect.

3. Size and Style: As indicated on Drawings and acceptable to applicable authorities.

4. Attachment: Method subject to Architect approval.

2.3 FABRICATION

A. Signs and Graphics:

1. Character Type: Characters on signs shall be raised 1/32” and shall be sans serif uppercase case characters accompanied by Grade 2 Braille.

2. Character Size: Raised characters shall be minimum 5/8” and maximum 2”.

3. Finish and Contrast: Contrast between character, symbols and their background shall be 70% minimum and have non-glare finish. See California Building Code Section 11B-703.5.1

4. Grade 2 Braille: California(contracted) Grade 2 Braille shall be used wherever Braille is required.

a. Dots shall be 1/10” on centers with 2/10” space between cells, measured from second column of dots in first cell to first column of dots in second cell.

b. Dots shall be raised minimum 1/.40” above background.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs in accordance with manufacturer recommendations and installation instructions, free from distortions and defects.

B. Dimensional and Halo-Lit Signage: Locate dimensional with spacing based on full-size computer-generated installation drawings secured to structure as required to resist anticipated loads.

1. Final Location: As approved in field by Architect based on full size drawings.

C. Toilet Room Door Signs: Install signs on doors after doors are painted and finished.

1. Location: Mount signs with centerline of sign between 58" and 60" height as required by applicable code.

2. Install centered and level, in line, in accordance with the manufacturer's recommendations.

3. Clean and polish, remove excess adhesive.

D. Toilet Room Wall Signs: Install signs on walls after surfaces on which they are to be mounted are painted and finished.

1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.

2. Install level, in line, in accordance with California Building Code and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.

3. Clean and polish, remove excess adhesive.

E. Tactile Exit Door Signs: Install at doors with lighted “EXIT” signs; apply after walls are finished.

1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.

2. Install level, in line, in accordance with the manufacturer's recommendations and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.

3. Clean and polish, remove excess adhesive.

F. Room Identification and Direction Signs: Install signs after walls are finished.

1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door for room identification signs, where indicated for direction signs.

2. Install signs level, in line, in accordance with the manufacturer's recommendations, California Building Code and ADA Standards.

3. Install room identification signs at doors to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.

4. Clean and polish, remove excess adhesive.

G. Emergency Evacuation Signs: Install signs after walls are finished.

1. Location: Mount signs at locations indicated, as directed by Architect and applicable authorities if not otherwise indicated.

2. Install signs level and in accordance with the manufacturer's recommendations and requirements of applicable authorities.

3. Clean and polish.

END OF SECTION

SECTION 10 21 10

METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide special height panel stainless-steel no-sight type privacy partitions for toilet compartments including hardware, attachment devices, and integral accessories as required for complete installation.

1. Urinal Screens: Provide wall mounted stainless-steel partitions for urinal screens including attachment hardware for complete finished installation.

B. Related Sections:

1. Section 10 28 00: Toilet accessories.

1.2 REFERENCES

A. Americans with Disabilities Act (ADA) Standards.

B. California Building Code: California Code of Regulations, Title 24, Part 2, requirements for providing accessibility for persons with disabilities.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature.

B. Shop Drawings: Clearly indicate partition layouts, swing of doors, elevations, anchorage and mounting details, panel construction, hardware, finishes and relevant dimensions.

1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives, sealants, and caulks.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Flush Metal Partition Corp.

B. General Partitions Mfg. Corp.

C. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide metal partitions including hardware, attachment devices, and integral accessories.

1. Toilet Compartment Type: Floor to ceiling pilasters with 72” high no-sight privacy type doors and panels mounted nominal 4” above finished floor unless otherwise required for access for persons with disabilities.

2. Urinal Screens: Provide wall mounted urinal screens.

B. Regulatory Requirements, Access: Comply with California Building Code and Americans with Disabilities Act (ADA) Standards.

1. Door Width: Provide minimum 32" clear door openings when front entry, minimum 34" clear door openings when side entry.

2. Spacing: Provide minimum 60" clear width, and front space as applicable for type of compartment. Provide wider space where partitions block wheelchair space due to mounting nominal 4” above finished floor.

a. Where spacing is not available increase mounting to height required to allow wheelchair to maneuver in accordance with building code and ADA.

3. Reinforcing: Provide reinforcing for grab bars indicated to be partition mounted.

4. Urinal Screens: Provide minimum 30" clear space at urinal.

C. Stainless-Steel: Stainless-steel, ASTM A666, Type 304, with Number 4 polished finish; manufacturer's standard gages for units specified.

D. Pilaster Shoes: Nominal 3" high; ASTM A666, Type 304, No. 4 polished finish; stainless-steel.

E. Attachments, Screws and Bolts: Stainless-steel; tamper proof type; heavy duty stainless-steel or extruded aluminum brackets.

F. Hardware: Stainless-steel.

1. Hinges: Cast pivot hinges, gravity self-closing type, adjustable for door close positioning; nylon bearings.

2. Latch: Slide latch; door strike and keeper with rubber bumper.

3. Coat Hook/Bumper: Combination coat hook and bumper unit, maximum 48" above finished floor.

4. Wall Bumper: Wall mounted rubber bumper for out-swinging doors.

5. Pulls: Manufacturer’s standard; provide two "U-shaped" pulls immediately below latch at compartments accessible to persons with disabilities (compartments with grab bars), one inside and one outside.

2.3 FABRICATION

A. Fabricate partitions in accordance with FS RR-P-1352.

B. Doors and Panels: Minimum 1" thick by minimum 24" wide by minimum 72" high sheet steel face pressure bonded to sound deadening core.

1. Provide wider doors where required for accessibility for persons with disabilities.

C. Pilasters: Nominal 1-1/4" thick, constructed same as doors, of sizes required to suit cubicle widths and spacing.

D. Provide formed and closed edges for doors, panels, and pilasters; miter and weld corners and grind smooth; formed for no-sight privacy between panels, pilasters, and doors.

E. Internal Reinforcement: Concealed type as required for attached hardware, fittings, and accessories; mark locations of reinforcement for compartment mounted washroom accessories.

1. Coordinate location of accessories with Section 10 28 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site conditions to which work is to be applied.

B. Take site dimensions affecting this work.

C. Ensure correct spacing and size of plumbing fixtures; take special note of fixtures in compartments indicated to be designed for persons with disabilities to assure clearances complying with access regulations.

D. Ensure correct location of built-in framing, anchorage, and bracing, where required.

3.2 INSTALLATION

A. Install units in accordance with manufacturer recommendations and installation instructions, secure, plumb, level, and square.

B. Attach panel brackets securely to walls using anchor devices.

C. Attach panels and pilasters to bracket with through sleeve tamper proof bolts and nuts.

D. Provide for adjustment of floor to ceiling height variations with screw jack through steel saddles integral with pilaster; conceal fastenings with stainless-steel shoes, top and bottom.

E. Equip each door with hinges, latch, and coat hook/bumper combination.

1. At out swinging stall doors provide additional bumper on exterior of door, coat hook and bumper combinations are not acceptable.

F. Install door strike keeper and door bumper on each pilaster in alignment with door latch.

G. Adjust and align hardware to uniform clearance at vertical edges of doors not exceeding 3/16".

H. Adjust hinges to locate doors in partial open position when unlatched, except adjust hinges to return doors to closed position at stalls designed for use by persons with disabilities.

I. Anchor urinal screen panels to walls with continuous angle brackets on both sides.

3.3 CLEANING

A. Clean surfaces of oil and imperfections.

B. Field touch-up of scratches and defaced finishes will not be permitted; replace damaged, scratched and marred defective materials with new, undamaged materials.

END OF SECTION

SECTION 10 22 20

OPERABLE PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide manually operated, top supported, operable partitions with retractable seals, including hardware and accessories as required for complete, operable system.

1. Acoustical Closure: Review Contract Documents to ensure acoustical closure of adjacent construction matches operable partition acoustical performance to prevent flanking sound around partition into adjacent spaces.

a. Provide additional construction as required to ensure acoustical closure.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Design/Build Requirements: Provide services of registered structural engineer licensed in California with experience designing support for operable partitions.

1. Distribute loads to locations on building structure capable of supporting system without detrimental effects.

B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

A. Product Data: Furnish materials description, operation, and maintenance instructions.

B. Shop Drawings: Show partition and track layout, details of head, jamb, and sill conditions, stacking arrangement, hardware, and operating mechanism.

1. Indicate details of acoustical barrier over partitions system.

2. Provide template drawings for items supported or anchored by permanent construction.

C. Samples: Furnish samples of panel finish and edge construction.

D. Test Reports: Furnish copies of certificates by independent testing laboratories for following:

1. STC rating.
2. Flame spread classification.
1. Fire resistance ratings.
2. Field STC Tests: Furnish previous project test reports.

E. Certificates:

1. Manufacturer Certification: Furnish manufacturer's certification indicating system complies with Contract Documents.

2. Installer Acceptance: Furnish letter from manufacturer indicating acceptance of installer for this Project.

3. Design/Build Engineer Certification: Furnish certification from California registered engineer indicating structural support complies with Contract Documents and applicable codes without detrimental impact on building structure.

1.4 QUALITY ASSURANCE

A. Qualification of Installers: Minimum five years successful experience in installing operable partitions and accessories on comparable projects.

1. Acceptable to manufacturer of operable partition.

1.5 WARRANTY

A. Extended Correction Period: Provide for correcting failure of operable partition system from proper operation, including acoustical characteristics.

1. Special Warranty Period: Two years.

B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.

1. Period: Not less than 10 years.

2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Hufcor, Inc.

B. Modernfold, a DORMA Group Company.

C. Industrial Acoustics Co., Inc.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide manually operated operable partitions with retractable seals and including hardware and accessories.

1. Partition Type: Top-supported, side-stacking, manually operated, with flush panels; manufacturer's STC 55 or 56 system as required to achieve required field performance requirements.

    a. Basis of Design: Hufcor Series 641 system with metal face for maximum acoustical performance.

2. Acoustical Closure: Provide acoustical closure of adjacent construction as required to match operable partition acoustical performance and as required to prevent flanking sound around partition into adjacent spaces.

B. Design Requirements: Design system to be supported by building structure; designed connections by registered professional structural engineer licensed in California.

1. Distribute loads to locations on building structure capable of supporting system without detrimental effects.

C. Fire Performance Requirements: Provide products listed by Underwriters Laboratories (UL), or similar independent laboratory acceptable to applicable authorities.

1. Flame Spread/Smoke Developed: Provide products meeting code requirements for maximum 25 flame spread and 450 smoke developed; Class A, ASTM E84.

D. Field Acoustical Performance Requirements: Provide minimum three field sound transmission rating tests on previous projects of similar size and scope indicating system to be provided has minimum FSTC of NIC 42.

1. Ratings: Determined in accordance with ASTM E413; tests by Architect approved independent testing laboratory.

2. Field Sound Transmission Rating: Minimum FSTC of NIC 42 when tested in accordance with ASTM E336, using reverberant-field procedure and full octave bands rather than one-third octave bands.

3. Operable Partition to have sound-absorbing panels with a minimum NRC 0.75.

E. Partition Type: Top-supported, side-stacking, manually operated, with flush panels.

1. Panel Configuration: Individual panels unless otherwise indicated.

F. Panel Construction: Factory assembled, consisting of minimum 16 gage welded steel channel perimeter frame with intermediate stiles, high density sound retardant insulation.

1. Panel Thickness: Nominal 3" to 4" thick; review Drawings for space provided for panel storage; provide panel system suitable of allowable space.

    a. Notify Architect during bidding if Project design requires potential modification for system to comply with Contract Document.

    b. Failure to notify Architect during bidding signifies acceptance of conditions indicated.

2. Panel Skins: Minimum 24-gage steel with rust inhibitive prime coat of paint.

3. Panel Support Bolts: Minimum 1/2" diameter; of fail-safe design that prevents loosening or backing out after panels have been installed.

4. Panel Materials: Incombustible, moisture resistant, and dimensionally stable.

5. Construction: All steel construction.

G. Track System: Overhead track designed for extra heavy duty; secured to structural support system by adjustable bolts.

1. Panel Supports: Ball bearing trolley assembly, capable of universal movement, turning on a central bearing and shall not require radius turns or switching mechanisms.

H. Deflection Compensation: Design system to accommodate specified long-term dead load deflection of up to 1/2" at any point in span while maintaining operational and acoustical qualities.

I. Seals: Provide system with single mechanism to activate floor seals; seals shall not contact floor or track during movement of panels.

1. Floor Seals: Durometer rating compatible with floor surfaces.

2. Vertical Seals: Manufacturer's standard as required to achieve acoustical performance specified.

3. Seal Materials: Resistant to fatigue and cleaning compounds and shall not mar floor or ceiling finishes.

4. Floor Guide and Floor Attachments: Not permitted.

J. Fixed and Operable Closure Jambs: Acoustical type designed to maintain acoustical seal at perimeter walls and junctions of operable partition; secure to building walls.

K. System Supports and Anchors: ASTM A36 steel shapes as required to attach operable partitions to building structural system.

1. Provide bracing at track intersections to resist panel impacts.

L. Finish: Panel and door finish shall be heavy duty vinyl fabric, color and texture as selected by Architect.

1. Apply finish to panels in shop. Return into vertical panel seams and mechanically fasten with removable astragal at panel edge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine floor and overhead construction for conformance with tolerances; verify dimensions of in place and subsequent construction.

B. Installation of partition shall constitute acceptance of existing conditions.

3.2 INSTALLATION

A. Install operable partition system in accordance with manufacturer's recommendations and installation instructions as required to assure compliance with sound transmission test requirements.

1. Comply with ANSI E557, Standard Recommended Practice for Architectural Application and Installation of Operable Partitions.

2. Lubricate bearings and sliding parts; adjust to ensure smooth, easy operation.

3. Match operable partitions for color and pattern by using partition sections from cartons in same sequence as manufactured and packaged.

4. Broken, cracked, chipped, damaged, and deformed partitions are not acceptable.

B. Upon completion of installation, test operation of partition in presence of Architect.

C. Instruct Owner's personnel in operation and maintenance of partition.

3.3 FIELD QUALITY CONTROL

A. Site Acoustical Tests: Determine field sound transmission class values in accordance with ASTM E336; tests by Architect approved independent testing laboratory.

1. Field Sound Transmission Rating: Minimum FSTC of NIC 40 when tested in accordance with ASTM E336, using reverberant-field procedure and full octave bands rather than one-third octave bands.

2. Failed Tests: Make corrections and re-test.

3.4 CLEANING

A. Clean operable partition surfaces and adjacent surfaces soiled by operable partition work; avoid use of abrasive cleaners and solutions containing corrosive solvents.

1. Remove and replace panels and adjacent construction damaged by installation or cleaning operations.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide toilet accessories with attachment hardware and rough-in frames as required for complete, operational installation.

B. Related Sections:

1. Section 10 21 00: Hardware for toilet partitions, including coat hook/bumper mounted on partition doors, and wall bumpers for out swinging doors.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data illustrating each accessory at large scale.

1.3 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with *CAL*Green requirements including those relative to finish material pollution control for adhesives.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver inserts and rough-in frames to jobsite at appropriate time for building in.

B. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

C. Pack accessories individually, protect each item and its finish.

1.5 SITE CONDITIONS

A. Protect adjacent or adjoining finished surfaces from damage during installation of work of this section.

B. Before starting work notify Architect in writing of conditions detrimental to installation or operation of units.

C. Verify with Architect exact location of accessories.

1.6 WARRANTY

A. Extended Correction Period:

1. Replace mirrors which exhibit signs of desilvering or distortion.

2. Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Bobrick Washroom Equipment, Inc.

B. Bradley Corporation.

C. American Specialties, Inc.

D. Manufacturers listed on Toilet Accessories Schedules.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide toilet accessories with attachment hardware and rough-in frames.

1. Provide standard materials and finishes for accessories listed; where more than one material or finish is available and not otherwise indicated provide as selected by Architect from manufacturer's standard materials and finishes.

B. Regulatory Requirements - Access for Persons with Disabilities: Comply with California Building Standards Code and Americans with Disabilities Act (ADA) Standards.

C. Stainless-Steel Sheet: ASTM A666, commercial grade, Type 304, gages as standard with manufacturer of specified items.

D. Stainless-steel Tubing: ASTM A269, commercial grade, seamless welded.

E. Mirror Glass: ASTM C1036, q1 mirror select clear float glass with full silver coating, copper coating and organic coating; minimum 1/4" thick.

F. Sheet Steel: ASTM A1008, cold rolled stretcher leveled; minimum G90 galvanized coating, ASTM A924 and A653.

G. Adhesive: Epoxy type contact cement as recommended by accessory manufacturer; comply with applicable requirements for limitations on volatile organic compound (VOC) emissions.

H. Fasteners, Screws, and Bolts: Hot-dipped galvanized; as recommended by accessory manufacturer for component and substrate.

I. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing and supply.

1. Provide minimum six keys to Owner representative.

2. Coin Operated Units: Provide locked coin box keyed separately from standard units, coin operated units keyed alike.

2.3 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form exposed surfaces from one sheet of stock, free of joints.

C. Fabricate units with tight seams and joints, exposed edges rolled; hang doors and access panels with continuous piano hinges; provide concealed anchorage where possible.

D. Provide steel anchor plates and anchor components for installation on building finishes.

E. Form surfaces flat without distortion; maintain flat surfaces without scratches and without dents; finish exposed edges eased, free of sharp edges where potential exists for physical contact.

F. Back paint components where contact is made with building finishes, to prevent electrolysis.

G. Hot-dipped galvanize ferrous metal anchors and fastening devices.

H. Assemble components in shop; package complete with anchors and fittings.

2.4 FINISHES

A. Exposed Finishes: Stainless-steel, number 4, satin finish; satin chrome finish acceptable where stainless-steel not available for accessory item listed or scheduled.

B. Concealed Surfaces: Treat and clean, spray-apply one coat primer and baked enamel finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide templates and rough-in measurements.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's printed instructions using fasteners appropriate to substrate.

B. Install true, plumb, and level, securely and rigidly anchored to substrate.

C. Use tamper-proof, security type fasteners.

D. Adjust accessories for proper operation and verify mechanisms function smoothly.

E. Replace damaged and defective items.

F. Clean and polish exposed surfaces after removing temporary labels.

3.3 TOILET ACCESSORIES SCHEDULE

A. Refer to Drawings.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide semi-recessed cabinets for portable fire extinguishers with accessories as required for complete installation.

1. Fire Extinguishers: Owner furnished and installed.

B. Related Sections:

1. Division 21: Fire protection systems.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. J.L. Industries.

B. Larsen’s Manufacturing Co.

C. Potter Roemer.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide semi-recessed cabinets for portable fire extinguishers with accessories.

B. Fire Extinguisher Cabinets: Provide semi-recessed mounting unless otherwise indicated, maximum 4” extension beyond wall finish surface, provide trim suitable for installation indicated.

1. Type:

a. J.L. Industries/Ambassador Series.
b. Larsen’s Mfg. Co./Architectural Series.
c. Potter Roemer/Alta Series.
d. Substitutions: Refer to Section 01 25 00.

2. Typical Cabinet Depth: Provide cabinets designed for space available in walls with fire extinguisher cabinets, and of depth to house 2A-10BC multi-purpose dry chemical type fire extinguisher.

C. Trim: Manufacturer's standard edge trim for specified models.

D. Metal Gages: Provide manufacturer's standard gages for cabinets specified.

E. Construction: Mitered and welded one-piece tubular door frames; weld joints and grind smooth; manufacturer's standard steel box with white baked enamel interior finish and primed exterior finish.

1. Steel Doors and Trim: Manufacturer's standard, prime coat finished.
2. Doors: Break-glass type secured access, with inside latch and lock.
3. Door Hardware: Continuous hinge permitting door to open 180-degrees.

F. Fire Rated Wall Construction: Provide fire extinguisher cabinet manufacturer's material as required to maintain integrity of fire rated partitions where cabinets are in fire rated partitions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates and conditions under which fire extinguisher cabinets are to be installed.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinets in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.

B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

1. Wherever exact location of units is not shown, locate as directed by Architect.

3.3 IDENTIFICATION

A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.

B. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 10 56 10

METAL STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide metal storage shelving system with accessories as required for complete, finished metal storage system.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents.

B. Pre-Installation Meeting: Convene not less than one week prior to commencing work of this Section. Require attendance of those directly affecting work of this Section.

1. Review installation procedures and coordination required with related work.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

B. Shop Drawings: Include elevations at 1/2" scale, and half-size detail sections of every typical composite member.

1. Show anchors, joint system and other components not included in manufacturer's standard data.

C. Samples: Furnish samples of metal finish.

D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating compliance with Contract Documents and code requirements.

1.4 QUALITY ASSURANCE

A. Provide metal storage system produced by single manufacturer, including necessary mounting brackets, accessories, fittings, and fastenings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver compacted storage system until building is enclosed and ready for installation.

B. Protect system from damage during delivery, handling, storage and installation.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Penco Products, Inc.

B. Equipto.

C. W.W. Grainger, Inc.

D. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide metal storage shelving system with accessories.

B. Regulatory Requirements: Conform to California Building Code seismic requirements for storage and other applicable codes for seismic loading and safety requirements including CAL/OSHA.

C. Performance Criteria:

1. Design system, including columns, bases, connections, and anchorages to resist minimum lateral seismic force, Fp=0.25 Wp, in any direction, within allowable working stresses permitted by UBC.

    a. Maximum Lateral Deflection: 5/8" at top of shelving.

    b. Wp is defined as "total weight of shelving system plus 50-psf of shelving to account for book storage."

    c. Investigate stresses and deflections for shelves fully loaded in combination with seismic forces.

2. Overhead Bracing Between Shelf Units: Not allowed.

3. Diagonal Sway Bracing: Not allowed.

4. Shelf Loading: Design shelving for minimum 50 lbs/sf with temporary deflection not to exceed 3/16" with no permanent deflection.

D. Metal Shelving Units:

1. Basis of Design: Penco/RivetRite Shelving Units.

    a. Shelves: Penco/Hi-Performance Heavy Duty Class 1 Shelf.

2. Accessories: Provide as indicated on Drawings and as required for complete, secure, finished metal shelving system as indicated.

E. Steel: ASTM A36 or A336 furniture stock.

F. Fasteners: Cadmium plated steel.

G. Sheet Steel Finish: Manufacturer's standard thermosetting finish; consisting of cleaning, phosphatizing process and either thermosetting or powder coating.

1. Color: Provide colors as indicated, as selected by Architect from manufacturer's full range of colors where not indicated.

2.3 FABRICATION

A. Fabricate work in shop to greatest extent possible, before application of finish; remove sharp and rough edges and corners from cut metal and grind welds smooth.

B. Provide manufacturer's standard design and fabrication designed for loads specified and conforming to applicable codes.

C. Design units so shelves are completely adjustable without detrimentally affecting stability of system.

1. Provide for adjustment of shelf heights at maximum 1-1/2" increments, from top to bottom of units.

2. Standard Unit Sizes: As indicated on Drawings, with unit height of approximately 84", unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which metal storage system is to be installed.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units and accessories at locations shown in accordance with manufacturer's recommendations and installation instructions, level, plumb, secure and at proper height.

B. Cooperate with other trades for securing units to finished surfaces.

C. Install shelves at spacings as directed by Owner.

3.3 CLEANING AND PROTECTION

A. Clean units and repair or replace damaged units as directed by Architect.

B. Touch-up marred finishes or replace component parts as necessary to eliminate evidence of damage or deterioration.

END OF SECTION

SECTION 11 31 00

APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide residential type appliances with options and accessories as required for complete finished operational installation.

B. Related Sections:

1. Section 06 40 00: Custom cabinets and countertops.
2. Division 22: Plumbing connections.
3. Division 26: Electrical connections.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature for each type of appliance, including data indicating compliance with requirements and color selection.

1.3 QUALITY ASSURANCE

A. Certification Labels: Provide appliances which bear appropriate labels as follows:

1. Energy Ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and efficiency information as required by Federal Trade Commission.

2. UL Standards: UL labels required.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver appliances in manufacturer's undamaged protective containers, after spaces are ready to receive them.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Manufacturers listed on Appliances Schedule.

B. General Electric Co., Major Appliances Division.

C. Whirlpool Corp.

D. Maytag Corp., including Amana Appliances.

E. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide residential type appliances with options and accessories.

B. Performance Requirements: Provide appliances with Energy Star rating unless otherwise indicated.

C. Appliances: Provide as indicated listed on Appliance Schedule.

1. Options: Where appliances are available with options and options are not specifically indicated provide best quality options offered with appliance number indicated unless otherwise directed by Architect.

2. Colors and Finishes: Provide colors and finishes as indicated for appliances.

a. Where not otherwise indicated provide finishes as selected by Architect and Owner from manufacturer’s full range of colors and finishes including stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which appliances are to be installed.

3.2 INSTALLATION

A. Install appliances in accordance with manufacturer's instructions.

B. Coordinate with mechanical and electrical trades as necessary for proper service connections.

C. Ensure operating parts work freely and fit neatly.

3.3 ADJUSTING

A. Adjust hardware and moving parts as necessary.

3.4 PROTECTION

A. Protect appliances until Substantial Completion.

B. Repair or replace damaged parts, dents, buckles, abrasions, or other defects affecting appearance or serviceability, so appliances are undamaged at time of Substantial Completion.

3.5 APPLIANCE SCHEDULE

A. Refer to Drawings.

END OF SECTION

SECTION 11 53 13

LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. All laboratory fume hoods and electrical service fixtures specified herein and shown on the drawings shall be furnished, installed and internally pre-wired by the Laboratory Furnishings Contractor for single point final connections for electrical and mechanical at top of fume hood by the electrical and mechanical sub-contractors. Laboratory Furnishings Contractor shall demonstrate each hood to properly function in accordance with the specification. All fume hoods and associated base cabinet or table frame support assemblies, shall be seismically connected and braced to meet the requirements of the California Building Code.

1.2 SECTION INCLUDES

A. Chemical Fume Hoods.

1.3 RELATED SECTIONS

A. Division 5: Cold-Formed Metal Framing, for Backing in Walls for Laboratory Casework and Accessory Anchorage.

B. Division 9: Resilient Base Molding (around all fixed lab furnishings including fume hoods).

C. Section 11 53 43: Laboratory Sinks, Mechanical Fixtures and Electrical Fixtures.

D. Section 12 35 53: Laboratory Casework System and Accessories.

E. Division 22: Furnishing and Installation of Plumbing Utilities.

F. Division 23: Furnishing and Installation of Ductwork, Exhaust Fans, and Equipment.

G. Division 23: Final Connection of Duct Work and Mechanical Fixtures to Fume Hoods.

H. Division 26: Final electrical connections to fume hoods and to fume hood base cabinets with electrical requirements.

1.4 REFERENCES

A. SEFA 1.2 Laboratory Hoods.

B. SEFA 8-1999 Laboratory Furniture.

C. ASHRAE-110-R.

1.5 DELIVERY, STORAGE AND HANDLING

A. Schedule delivery of equipment so that spaces are sufficiently complete for installation immediately following delivery.

B. Protect finished surfaces from soiling or damage during handling and installation.

1.6 PROJECT CONDITIONS

A. Do not deliver or install equipment until the following conditions have been met:

1. Windows and doors are installed, and the building is secure and weather tight.
2. Ceiling, overhead ductwork and lighting are installed.
3. All painting is completed and flooring located below hoods is installed.

1.7 ACTION SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 23 - Shop Drawings, Product Data and Samples.

B. Product Data: Submit manufacturer's data for each component and item of fume hoods specified. Include fume hood and component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements Indicate location, size and service requirements for each utility connection.

C. Shop Drawings:

1. Provide 1/2" = 1'0" scale elevations of individual and battery of hood units showing cross sections, rough-in and anchor placements, tolerances and clearances. Indicate relation of units to casework, other laboratory equipment, surrounding walls, windows, doors and other building components.
2. Provide 1/4" = 1'0" rough-in plan drawings for coordination with trades. Rough-in shall show free area.

D. Work Surface Samples: Submit product sample of each type of fume hood work surface.

E. Finish Samples: Submit samples of each color of metal finish for hoods and other prefinished equipment and accessories specified for selection by the University's Representative.

F. Liner Samples: Submit product samples for each type of hood liner.

G. Instructions: Submit for review and approval.

1. Instructions to be inscribed on instruction plate to be attached to fume hoods, as specified in Part 2 of this Section.

2. Written instructions in booklet form providing additional details on safe and proper operation and maintenance.

H. Test Data: Submit test reports on each size and type of chemical fume hood verifying conformance to test performances specified.

I. Submit detailed seismic anchorage and attachment drawings and calculations complying with all California Building Code requirements and regulations for seismic restraint**.** Drawings and calculations to be stamped and signed by a structural engineer licensed in the state of California.

1.8 QUALITY ASSURANCE

A. Single Source Responsibility: Fume hoods, work surfaces and accessories, Section 11 53 43 Laboratory Sinks, Mechanical and Electrical Fixtures and Section 12 25 53 Laboratory Casework shall be furnished by a single laboratory furniture supplier. Proposals from brokers or multiple furniture suppliers will not be accepted.

B. The supplier for work in this section shall use established organizations with production facilities including test facilities in the manufacturing plant, all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to complete an installation of this size and type within the required time limits:

1. Ten years or more experience in manufacture of Fume Hoods and associated laboratory equipment of type specified.
2. Twenty installations of equal or larger size and requirements within the last five years.

1.9 WARRANTY

A. Submit manufacturer' and installer's Warranty stating that the lab fume hood assemblies (from floor to connection to service panel above fume hood) provided and installed for this project shall be free from all defects in material, manufacture and installation for a period of two years from the date of substantial completion and that the lab furnishings contractor shall make corrections if defects are discovered during that time period.

PART 2 - PRODUCTS

2.1 CHEMICAL FUME HOODS

A. Manufacturer: Design of chemical fume hoods are based on products manufactured by Mott Manufacturing. Provide Mott Safeguard fume hood, in accessible configuration, as required to comply with the CA Bldg. Code and the ADA and the project drawings. Kewaunee Supreme Air Venturi or approved equal fume hood models are also acceptable product lines providing the fume hoods provided comply with the project requirements.

2.2 DESIGN REQUIREMENTS

A. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.

B. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20% of the average face velocity at any designated measuring point as defined in this section.

C. Average illumination of work area: Minimum 80 foot candles. Work area shall be defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches.

D. Fume hood shall be designed to minimize static pressure loss with adequate slot area and bell-shaped exhaust collar configuration. Maximum average static pressure loss readings taken three diameters above the hood outlet from four points, 90 degrees apart, shall not exceed the following maximums with sash in fully open position:

Face Velocity	Measured S.P.L. (W.G.)
75 F.P.M.	0.18 inches
100 F.P.M.	0.30 inches
125 F.P.M.	0.45 inches
150 F.P.M.	0.60 inches

E. Noise Criteria: Test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Reading taken 3' in front of open sash at 110 fpm face velocity.

F. Where shown to be accessible by the physically handicapped on the drawings, fume hoods are to be provided and installed to be fully in compliance with the accessibility provisions of the California Building Code and the Americans with Disabilities Act.

G. Fume hood operational criteria is a minimum face velocity of 100 feet per minute and a minimum sash opening height of 18 inches. Provide adjustable sash stops set at 18" height at each fume hood. Sash stops must be able to be overridden for

fume hood setup. Sashes shall automatically close by gravity to the 18" opening height when raised higher other than for full sash opening fume hood setup mode. When sash is fully closed, the fume hood airflow will go into lower airflow volume mode.

H. Fume Hood Ceiling Enclosures shall be provided for all project fume hoods. Ceiling enclosures shall be of painted metal construction to match fume hood exteriors and have easily removable panels as necessary in order to access and service utility connections and light fixture on tops of fume hoods. Gauge of ceiling enclosure material shall match that of fume hood side panels.

2.3 PERFORMANCE REQUIREMENTS

A. Metal Finish Performance Requirements:

1. Abrasion resistance; maximum weight loss of 5.5 mg. per 100 cycle when tested on a Taber Abrasion Tester #E40101 with 1000 gm wheel pressure and Calibrase #CS10 wheel.
2. Hardness: Surface hardness equivalent to 4H or 5H pencil.
3. Humidity resistance: Withstand 1000-hour exposure in saturated humidity at 100-degree F.
4. Moisture resistance:

    a. No visible effect to surface finish after boiling water trickled over test panel inclined at 45 degrees for five minutes.
    b. No visible effect to surface finish following 100-hour continuous application of a water-soaked cellulose sponge, maintained in a wet condition throughout the test period.

5. Adhesion: Score finish surface of test panel with razor blade into 100 squares, 1/16" x 1/16", cutting completely through the finish but with minimum penetration of the substrate, and brush away particles with soft brush. Minimum 95 squares shall maintain their finish.
6. Salt spray: Withstand minimum 200-hour salt spray test.
7. Chemical resistance:

    a. Test procedure: Apply 10 drops (approximately 0.5 cubic centimeters) of each reagent identified to the surface of the finished test panels laid flat and level on a horizontal surface. Ambient temperature: 68-72 degrees F. (20-22 degrees C.). After one-hour flush away chemicals with cold water and wash surface with detergent and warm water at 150 degrees F. (65.6 degrees C.) and with alcohol to remove surface stains. Examine surface under 100-foot candles of illumination.
    b. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

        1) Excellent: No change to slight detectable change in color or gloss.
        2) Good: Clearly discernible change in color or gloss. Finish remains intact and protective with no significant impairment to function or life.

3) Failure: Obvious and significant deterioration, visible blistering, bare spots, or roughness of surface.

c. Minimum test results: Concentration by weight

	REAGENT	RATING
1.	Acetic Acid, 93%	Excellent
2.	Formic Acid, 33%	Good
3.	Hydrochloric Acid, 37%	Good
4.	Nitric Acid, 25%	Good
5.	Nitric Acid, 60%	Excellent
6.	Sulfuric Acid, 28%	Excellent
7.	Sulfuric Acid, 85%	Good
8.	Ammonium Hydroxide, 28%	Excellent
9.	Sodium Hydroxide, 10%	Excellent
10.	Sodium Hydroxide, 25%	Excellent
11.	Acetone	Excellent
12.	Carbon Tetrachloride	Excellent
13.	Ethyl Acetate	Excellent
14.	Ethyl Alcohol	Excellent
15.	Ethyl Ether	Excellent
16.	Formaldehyde, 37%	Excellent
17.	Hydrogen Peroxide, 5%	Excellent
18.	Methylethyl Ketone	Excellent
19.	Phenol, 85%	Good
20.	Xylene	Excellent

B. Quality Control Testing of Fume Hoods:

1. Evaluation of manufacturer's standard product shall take place in manufacturer's own test facility, with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer at no cost to the University. Test requirements shall meet the standards of ASHRAE-110-R.
2. Submit test report consisting of the following test parameters and equipment for each hood width and configuration specified.
3. Hood shall achieve a rating of 4.0 AM 0.1 P.P.M. or better.

2.4 MATERIALS AND FINISHES

A. Steel: High quality, cold rolled, mild steel meeting requirements of ASTM A366; gauges U. S. Standard and galvanized.

B. Stainless-steel: Type 304; gauges U. S. Standard.

C. Ceiling Closure Panels: Minimum 18 gauge; finish to match hood exterior.

D. Bypass: Low resistant type, providing a clean air stream behind the sash plane.

E. Safety Glass: Nominal 1/4" thick laminated safety glass.

F. Sash Belts: 1/2" wide stainless-steel-reinforced polyurethane notched belts that engage a sprocketed shaft drive.

G. Sash Guides: Corrosion resistant polyvinyl chloride.

H. Vertical Sash Assembly: The sash shall have a neutral colored polyvinyl chloride horizontal member at the top and a full-length aerodynamic aluminum handle at the bottom. The sash shall be counterbalanced with a single weight to prevent tilting and binding during operation. The sash shall be connected to the counterweight system with two ½" wide stainless-steel reinforced polyurethane notched belts that engage a sprocketed shaft drive.

I. Sash Pull: Full width corrosion resistant plastic, stainless-steel or steel with chemical resistant powder coating.

J. Gaskets: 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood. Access panels that are not gasketed are not acceptable.

K. Fastenings:

1. Exterior structural members attachments: Sheet metal screws, zinc plated.
2. Interior concealed fastening devices: To be corrosion resistant non-metallic material. Exposed screws not acceptable. (Screw head "caps: not acceptable.)
3. Exterior panel member fastening devices: To be corrosion resistant non-metallic material. Exposed screws not acceptable.

L. Instruction Plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information covering recommended locations for apparatus and accessories, baffle settings and use of sash.

M. Metal Finish:

1. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pretreat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.
2. Application: Electrostatically apply urethane powder coat selected from manufacturer's standard color offering and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:

    a. Exterior and interior surfaces exposed to view: 1.5 mil average and 1.2 mil minimum.
    b. Backs of cabinets and other surfaces not exposed to view: 1.0 mil average.
    c. Color to be selected by University’s Representative from manufacturers standard color selection.

2.5 FUME HOOD CONSTRUCTION

A. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4-7/8" thick.

1. Wall consists of a sheet steel outer shell and a corrosion resistant inner liner, and houses and conceals steel framing members, attaching brackets and remote operating service fixture mechanisms and services. Panels must be attached to a full frame construction, minimum 14-gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracketry from hood interior.
2. Access to fixture valves concealed in wall provided by exterior removable access panels, gasketed access panels on the inside liner walls, or through removable front posts.

B. Exhaust Outlet: Round or rectangular with ends radiused, shaped and flanged, or round. 18-gauge steel finished with off white color powder coating or Type 316 stainless steel. If rectangular exhaust outlet is provided, provide rectangular to round transition for connection to round ductwork.

C. Access Opening Perimeter: Air foil or streamlined shape with all right-angle corners radiused or angled. Bottom horizontal foil shall provide nominal one-inch bypass when sash is in the closed position. Bottom foil shall be removable without use of special tools. Bottom foil shall provide access areas for electrical cords. Bottom air foil: 12-gauge steel with powder coating or Type 316 stainless-steel for acid and abrasion resistance. The airfoil shall assure a flow of air rearward within ½” above the worksurface at all hood operating face velocities.

D. Fume Hood Sash: Vertical rising sash with clear, unobstructed, side to side view of fume hood interior and service fixture connections. Sash and clear panel above sash shall provide a minimum 5’-10” high clear view into hood interior.

1. Bottom sash rail: 2" maximum, 18-gauge steel with powder coating finish. Provide integral formed, flush pull the full width of bottom rail.
2. Set safety glass into rails in deep form, extruded polyvinyl chloride glazing channels.
3. Sash system: Cable and Pulley or Chain and Sprocket which prevents sash tilting and permits one finger operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure. Life cycle test 100-pound sash and weight to 100,000 cycles without sign of failure. Provide independent test data.
4. Bottom sash rail shall be 16-gauge steel with powder coating finish.
5. Open and close sash against rubber bumper stops. Sash shall lock in closed position with manual override.
6. Align top of the bottom sash rail flush with the hood interior work surface in closed position. Construct sash frames in a manner that will not require user to reach over the sash frame.

E. Fume Hood Liner: Nominal 1/4" thick reinforced polyester panel; smooth finish and integral white color in final appearance. Flexural strength: 14,000 psi. Flame spread: 15 or less per U.L. 723 and ASTM E84-80.

F. Baffles: Baffles providing controlled air vectors into and through the fume hood shall be fabricated of the same material as the liner. Provide exhaust slots in multiple sections with vertical slots and a continuous horizontal slot at the work surface. Each baffle panel shall be easily removable from the interior, without requiring liner disassembly.

G. Baffle Adjustment: Provide fixed baffles pre-set at positions to optimize fume hood performance.

2.6 FUME HOOD LINER PERFORMANCE REQUIREMENTS

A. Test Procedure:

1. Test No. 1 - Spills and Splashes:

a. Suspend in a vertical plane a 42" (horizontal) by 12" (vertical) panel divided into 3/4" wide vertical columns, each column numbered 1 through 49.
b. Apply five drops of each reagent listed with an eye dropper.
c. Apply liquid reagents at top of panel and allow to flow down full panel height. (CAUTION! Flush away any reagent drops.)

2. Test No. 2 - Fumes and Gases:

a. Divide 24" x 12" panel into 2" squares, each square numbered 1 through 49.
b. Place 25 milliliters of reagent into 100 milliliter beakers and position panel over beaker tops in the proper sequence. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.

3. After 24 hours, remove panel, flush with water, clean with naphtha and detergent, rinse, wipe dry and evaluate.

B. Evaluation Ratings: Changes in surface finish and function shall be described by the following ratings:

1. No effect: No detectable change in surface material.
2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration

C. Test Results: Polyester Fume Hood Liner

Reagent List Concentrations by Weight		Test No. 1 Rating Spills	Test No. 2 Fumes
1.	Sodium Hydroxide Flake	No effect	No effect
2.	Sodium Hydroxide, 40%	Excellent	No effect
3.	Sodium Hydroxide, 20%	Excellent	No effect
4.	Sodium Hydroxide, 10%	Excellent	No effect
5.	Ammonium Hydroxide, 28%	No effect	No effect
6.	Methylene Chloride	No effect	No effect
7.	Chloroform	No effect	No effect
8.	Carbon Tetrachloride	No effect	No effect
9.	Trichlorethylene	No effect	No effect
10.	MonoChlorBenzene	No effect	No effect
11.	Tincture of Iodine	No effect	Good
12.	Methyl Alcohol	No effect	No effect
13.	Ethyl Alcohol	No effect	No effect
14.	Butyl Alcohol	No effect	No effect
15.	Phenol, 85%	No effect	Excellent
16.	Cresol	No effect	No effect
17.	Sodium Sulfide, Saturated	Good	Excellent
18.	Furfural	Good	No effect
19.	Dioxane	No effect	No effect
20.	Zinc Chloride	No effect	No effect
21.	Benzene	No effect	No effect
22.	Toluene	No effect	No effect
23.	Xylene	No effect	No effect
24.	Gasoline	No effect	No effect
25.	Naphthalene	No effect	No effect
26.	Methyl Ethyl Ketone	No effect	No effect
27.	Acetone	No effect	No effect
28.	Ethyl Acetate	No effect	Excellent
29.	Amyl Acetate	No effect	No effect
30.	Ethyl Ether	No effect	No effect
31.	Silver Nitrate, 10%	Excellent	No effect
32.	Di Methyl Formamide	No effect	No effect
33.	Formaldehyde, 37%	No effect	No effect
34.	Formic Acid, 88%	No effect	No effect
35.	Acetic Acid, Glacial	No effect	No effect
36.	Dichlor Acetic Acid	No effect	No effect
37.	Chromic Acid, Saturated	Fair	No effect
38.	Phosphoric Acid, 85%	Excellent	No effect
39.	Sulfuric Acid, 33%	Excellent	No effect
40.	Sulfuric Acid, 77%	Excellent	No effect
41.	Sulfuric Acid, 93%	Excellent	No effect
42.	Hydrogen Peroxide, 30%	No effect	No effect
43.	Acid Dichromate	Excellent	Excellent
44.	Nitric Acid, 20%	No effect	No effect
45.	Nitric Acid, 30%	No effect	No effect
46.	40 & 47 Equal Parts	No effect	Excellent

47.	Nitric Acid, 70%	No effect	No effect
48.	Hydrofluoric Acid, 37%	No effect	No effect
49.	Hydrochloric Acid, 48%	Excellent	Excellent

2.7 FUME HOOD TYPES

A. Constant Volume / Bypass Type Accessible Fume Hoods (with low airflow mode when sash is in the closed position):

1. Variable volume type with built-in automatic compensating restricted bypass.
2. Bypass: Positive in action and controlled by the sash operation.
3. Low impedance, directionally louvered panel provided in the lintel bypass area and one inch bypass provided immediately above the work surface and directly below the bottom horizontal sash rail.
4. As sash is lowered, bypass design shall work with Variable Volume Fume Hood airflow controls system to maintain constant fume hood face velocity.
5. Provide in accessible and non-accessible configurations.
6. Flush bottom air foil and rectangular to round fume hood duct transition shall be stainless-steel. Duct transition shall be integrally welded to single piece stainless-steel fume hood interior and ground smooth.
7. Fume hood to be supported on floor mounted fixed base cabinets.
8. Accessible Fume Hood features are to include the following:

    a. Accessible Fume Hood worksurface to be installed at a max height of +34” from finished floor.
    b. Accessible Fume Hoods to have all user accessible controls (plumbing services (if any), electrical services, and light switch) mounted no higher than 48 inches from the finished floor.

2.8 MECHANICAL AND ELECTRICAL FIXTURES

A. Fume Hood Service Fixtures and Fittings: No plumbed services are required for the project fume hood.

B. Fume Hood Light Fixture: Lighting shall be UL listed LED light fixture with driver, as required, installed on top of fume hood. Provide safety glass panel cemented and sealed to the hood roof.

1. Interior of light fixture: White, high reflecting plastic enamel.
2. Size of light fixture: Largest possible length of fixture up to one 48" fixture or two shorter fixtures for six-foot fume hoods.
3. Include lamps with fixtures.
4. Color of light shall be close to natural daylight.
5. Fume hood illumination to be 100-foot candles at worksurface level.

C. Electrical Services: Three wire grounding type receptacle rated at 120 V.A.C. at 20 amperes.

1. Flush plates: Black acid resistant thermoplastic.

2. Fume hoods shall be prewired to a junction box on top of hood. Wiring to comply with National Electric Code (NEC) and California Electrical Code.
3. Provide one duplex electrical receptacle on each exterior side channel of the fume hood.
4. Provide wiring for one dedicated 20A circuit for fume hood.

D. Fume Hood Air Flow Monitor / Alarm:

1. An airflow monitor/alarm shall be provided with the fume hood. The airflow monitor alarm is to be mounted to the front of the fume hood as indicated on the drawings and shall provide an audio and visual alarm when the fume hood airflow is below safe operating levels. The fume hood will be connected to a two-speed exhaust fan and the fume hood is to operate with high level airflow when the sash is open (to any vertical position) and at low airflow when sash is in the closed position. When fume hood sash is in high airflow level mode (sash open), the fume hood airflow monitor/alarm is to go into alarm mode when airflow is below safe operating level. When fume hood is in low airflow mode (sash closed), the fume hood airflow monitor/alarm is to go into alarm mode when the airflow drops below 150 air changes per hour in the work area of the fume hood. The airflow monitor/alarm device shall be provided with a sash position sensor as required so the airflow monitor/alarm knows when the sash is in open position and when sash is in the closed position and different alarm set points shall apply for the two different (high and low) airflow sash position / operational modes. The alarm shall have a digital readout for airflow monitor/alarm setup and to state reason for alarm when in alarm mode. The airflow monitor/alarm shall have a button to silence the alarm when in alarm mode. The airflow monitor/alarm device shall also have dry contacts for possible connection to building management system for alarm signal.
2. Provide TEL AFA 1000, airflow monitor, or equal by Dwyer with accessories and configured as required to provide low airflow alarms as described in this section and as required.

E. Fume Hood Connection to Building Electrical Service:

1. Pre-wire fume hood to j-box at top of fume hoods. J-box at top of fume hoods to be provided by Lab Furnishings Contractor. Electrical connection from j-box at top of fume hood to the building electrical system is the responsibility of Div. 26.

2.9 WORK SURFACES

A. Work Surfaces: 1-1/4" thick surface, dished a nominal 3/8 inch to contain spills.

1. Molded epoxy resin work surfaces in color to match the epoxy resin worksurface color in project lab areas.

B. Test Procedure: Apply five drops of each reagent to surface and cover with 25MM watch glass, convex side down; test volatiles using one ounce bottle stuffed with saturated cotton. After 24 hour exposure flush surface, clean, rinse and wipe dry.

C. Evaluation Ratings: Change in surface finish and function shall be described by the following ratings:

1. No effect: No detectable change in surface material.
2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
5. Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration.

D. Test Results - Epoxy Resin Work Surface:

	Reagent	Rating
1.	Hydrochloric Acid, 37%	Excellent
2.	Sulfuric Acid, 33%	No effect
3.	Sulfuric Acid, 77%	No effect
4.	Sulfuric Acid, 96%	Failure
5.	Formic Acid, 90%	Excellent
6.	Nitric Acid, 20%	Excellent
7.	Nitric Acid, 30%	Excellent
8.	Nitric Acid, 70%	Good
9.	Hydrofluoric Acid, 48%	Fair
10.	Phosphoric Acid, 85%	No effect
11.	Chromic Acid, 60%	Failure
12.	Acetic Acid, 98%	Excellent
13.	3 and 8 Equal Parts	Excellent
14.	Ammonium Hydroxide, 28%	No effect
15.	Sodium Hydroxide, 10%	No effect
16.	Sodium Hydroxide, 20%	No effect
17.	Sodium Hydroxide, 40%	No effect
18.	Sodium Hydroxide Flake	No effect
19.	Sodium Sulfide	Excellent
20.	Zinc Chloride	No effect
21.	Tincture of Iodine	Excellent
22.	Silver Nitrate	No effect
23.	Methyl Alcohol	No effect
24.	Ethyl Alcohol	No effect
25.	Butyl Alcohol	No effect
26.	Benzene	Excellent
27.	Xylene	No effect
28.	Toluene	Excellent
29.	Gasoline	No effect
30.	Dichlor Acetic Acid	Good
31.	Di Methyl Formamide	Excellent
32.	Ethyl Acetate	No effect
33.	Amyl Acetate	Excellent
34.	Acetone	Excellent
35.	Chloroform	Excellent
36.	Carbon Tetrachloride	No effect
37.	Phenol	Excellent
38.	Cresol	Excellent
39.	Formaldehyde	No effect
40.	Trichlorethylene	Excellent
41.	Ethyl Ether	Excellent
42.	Furfural	Good
43.	Methylene Chloride	Excellent
44.	Mono Chlor Benzene	Good
45.	Dioxane	Excellent
46.	Methyl Ethyl Ketone	Excellent

47.	Acid Dichromate	Fair
48.	Hydrogen Peroxide	No effect
49.	Naphthalene	Excellent

2.10 CUP SINKS

A. No Cupsinks are required at the project fume hood.

2.11 FUME HOOD BASE CABINETS

A. Cabinet Fabrication and Finish: As specified in Section 11 35 53 - LAB CASEWORK AND ACCESSORIES.

B. Steel Flammable Storage Cabinets:

1. Top, Bottom and Sides: 18 gauge steel, double wall construction with 1-1/2" air space, removable access and back panels; all joints welded. Set bottom of door two inches above bottom of cabinet to create two inch deep well to contain spillage of liquids.
2. Hardware:

    a. 3 point latching device and lock.
    b. Full length piano hinge.
    c. Door operation: Self-closing with fusible link.

3. Upper and Lower Arrester Vents: Factory Mutual approved vents located so that they can be plugged both internally and externally to assure insolation of stored fluid, but can be opened for ventilation means if required.
4. Cabinet Grounding Attachment: Screw at base of cabinet for firm attachment of grounding wire.
5. Cabinet Color and Markings:

    a. Cabinet color: as selected by the architect from the manufacturer’s standard color options.
    b. Mark with Factory Mutual approval, manufacturers model number and storage capacity.
    c. Warning signs: Label cabinet: "FLAMMABLE - KEEP FIRE AWAY".

6. Cabinet Venting: Flammable storage cabinets are not to be vented.

C. Acids/Bases Storage Cabinets:

1. Cabinets shall be constructed in accordance with the casework design and fabrication requirements for metal laboratory casework.
2. Lining: Cabinets shall be lined with 1/4" thick chemical resistant board lining to match fume hood liner board. Cabinets shall include one full depth adjustable shelf lined with 1/4" thick liner board.
3. Venting: Corrosives, Acids and Bases storage cabinets are to be vented to the exhaust ductwork above the fume hood. Lab furnishings contractor to provide chemical resistant flexible vent hose through fume hood side channels to ceiling enclosure space above the fume hood for connection to the exhaust ductwork by the project mechanical sub-contractor.

4. Cabinet Label: “Acids Storage” or “Bases Storage”, as applicable. Match lettering size, style and color on Flammable Storage Cabinets.

2.12 ENCLOSURES

A. Ceiling Enclosures: Provide painted metal ceiling enclosure panels from top of fume hood superstructure to underside of suspended ceiling above at labs with suspended ceilings.

1. Ceiling enclosure panel assembly shall be constructed in accordance with the design and fabrication requirements for metal laboratory casework.
2. Ceiling enclosure panels to be supported from top of fume hood and shall not require attachments to ceiling assembly.
3. Ceiling enclosure panels to be removable for service of items at top of fume hood.
4. Provide louver in ceiling enclosure if required for proper operation of the fume hood by-pass.
5. Finish and color of ceiling enclosure panels to match the finish and color of the fume hood superstructure.
6. Ceiling shall be installed over the fume hood as though there was not to be a ceiling enclosure. Provide tightly fitted and neatly constructed curving edge angle or flanged collar for ceiling assembly to terminate above around the fume hood exhaust duct.

B. Fume Hood Base Cabinet Side Enclosure Panels: Where fume hood base cabinet sides do not abut adjacent walls or other fixed base cabinets, provide removable painted metal enclosure panels in same plane as sides of base cabinets from floor to underside of epoxy worksurface.

2.14 SOURCE QUALITY CONTROL TESTING OF FUME HOODS

A. Submit a test report, for each type and size of hood, for the standard product previously tested, if the product is identical to equipment being provided for this project.

B. Evaluation of standard product shall have been conducted in the manufacturer’s test facility in accordance with the method prescribed in the current version of ANSI/ASHRAE 110.

C. Hoods shall achieve a rating of 4.0 AM 0.05 PPM or better.

PART 3 - EXECUTION

3.1 FUME HOOD INSTALLATION

A. Install fume hoods and equipment in accordance with manufacturer's instructions and local code requirements.

B. Install equipment plumb, square and straight with no distortion and securely anchored.

C. All fume hoods shall be seismically braced per California Building Code requirements. Lab furnishings seismic calculations shall be based on the following conditions.

1. Fume Hoods at wall conditions shall be braced to walls. Wall backing shall be installed to face of studs, as required by LF installation and defined by LF contractor, by Div. 9.

3.2 FIELD QUALITY CONTROL TESTING OF FUME HOODS

A. Field test each fume hood as installed in accordance with the method prescribed in the current version of ANSI/ASHRAE 110. Submit report to University's Representative to demonstrate the hoods are safe for use.

B. Hoods shall achieve a rating of 4.0 AM 0.05 PPM or better.

C. Affix testing date and label to fume hood exterior at location approved by University's Representative.

3.3 ADJUSTING

A. Repair or remove and replace defective work, as directed by University's Representative upon completion of installation.

B. Adjust sash, fixtures, accessories and other moving or operating parts to function smoothly.

3.4 CLEANING

A. Dust off, broom clean equipment, touch up as required.

3.5 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of equipment from exposure to other construction activity.

B. Advise contractor of procedures and precautions for protection of material and installed fume hoods from damage by work of other trades.

END OF SECTION

SECTION 11 53 43

LABORATORY SINKS, MECHANICAL AND ELECTRICAL FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work included:

1. Furnish and install all laboratory sinks as specified herein and as indicated on the Laboratory Furnishings Drawings.
2. Furnish, as specified herein and as indicated on the Laboratory Furnishings Drawings, for installation by Division 22, 23 and 26, the following Mechanical and Electrical fixtures and related fittings:

    a. Lab fittings, valves and related components.

1.2 RELATED SECTIONS

A. Section 11 53 13 - Laboratory Fume Hoods.

B. Section 12 25 53 - Laboratory Casework System and Accessories.

C. Division 22 - Plumbing.

D. Division 23 - Mechanical.

E. Division 26 - Electrical.

1.3 ACTION SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 23 -Shop Drawings, Product Data and Samples.

B. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment and products for work in this section.

C. Samples: Submit one sample of each type of specified fixture and valve for any fixtures which are not the specified make and model number of a standard product and any non-standard/custom fixtures.

D. Submit scaled shop drawing installation details of service fixtures at lab furnishings system modules, at overhead service carriers and at overhead service panels.

E. Submit list of any concern the lab furnishings contractor has about the suitability of the service fixture for it’s intended purpose and recommendations for how to resolve the concerns.

1.4 QUALITY ASSURANCE

A. Manufacturers for work specified in this section shall have an established organization and production facility with ten years documented experience specializing in the manufacture of the type of equipment specified, with an experienced Engineering Department. Each shall have demonstrated ability to produce the specified equipment of the required quality and quantity for complete installation in a project of this type and size within the required time limits.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver fittings and fixtures to jobsite in recommended packaging, with each fitting individually packaged, marked, and scheduled for distribution.

B. Inventory fittings and verify that type and quantity are correct prior to distribution to the appropriate trade/subcontractor.

C. Store in a clean, dry location.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary for the approval of the University's Representative and at no additional cost to the University.

1.6 WARRANTY

A. Submit manufacturer' and installer's Warranty stating that the products provided and installed for this project shall be free from all defects in material, manufacture and installation for a period of two years and that the lab furnishings contractor shall make corrections if defects are discovered.

PART 2 - PRODUCTS

2.1 MECHANICAL AND ELECTRICAL SERVICE FITTINGS AND EMERGENCY FIXTURES

A. Manufacturer: Design of mechanical service fittings and fixtures is based on products manufactured by Water Saver Faucet Company. All service fittings and fixtures shall be the product of one manufacturer. Valve products of Chicago Faucet or equal manufacturers may be supplied provided they meet the product characteristics specified and work within space requirements of the project.

B. General Requirements:

1. All laboratory service fixtures shall have the construction and meet the performance requirements set forth in this section.

2. Laboratory gas and water service fixtures shall be furnished and delivered to point of use for installation by the plumbing contractor under Division 22.

Fixtures for pre-plumbed items such as fume hoods and biological safety cabinets are to be provided and installed by LF Contractor.

3. Laboratory electrical and telecom service fixtures shall be furnished and delivered to point of use for installation by the electrical contractor under Division 26. Fixtures for pre-wired items such as fume hoods and biological safety cabinets are to be provided and installed by LF Contractor.
4. All laboratory gas, water, electrical and telecom service fixtures shall be the product of one fixture manufacturer to assure uniform appearance and ease of maintenance of the laboratory facility. Remote control valves and fittings furnished with fume hoods provided in Section 11 53 13 shall be the product of the same fixture manufacturer.
5. All service fixtures shall be factory assembled (including the assembly of valves and shanks to turrets, flanges and other mounting accessories), and each fixture shall be individually factory tested in the manner and at the pressures specified.
6. All service fixtures shall be designed to minimize exposed surfaces on which dust, dirt and airborne contaminants may collect and to facilitate cleaning and maintenance of the service fixture.
7. Color code requirements for indexing service fixtures shall be as follows:

Service	Index Color	Letter Color	Symbol
Cold Water	Green	White	CW
Hot Water	Red	White	HW
Gas	Blue	White	GAS
Air	Orange	White	AIR
Vacuum	Yellow	Black	VAC
Nitrogen	Brown	White	NIT
Steam	Black	White	STM
Deionized Water	White	Black	DI
Other Services on Application			

8. Vacuum breakers shall be provided for all lab water fixtures. All vacuum breakers shall be certified by the American Society of Sanitary Engineers (ASSE) under Standards 1001 and 1035, as applicable. All valves for gas service shall be certified by the American Gas Association (AGA) under ANSI Z21.15.
9. All electrical devices shall be UL Certified. All electric pedestal boxes shall be certified by Underwriters Laboratories (UL) under Standard UL514A.

C. Finish:

1. Chrome with clear epoxy coating.

D. Performance Requirements:

1. Chemical resistance: All coating material shall meet the following tests for chemical resistance:

   a. Fume test: Suspended coated samples in a container at least 6 cu. Ft. capacity, approximately 12" above open beakers, each

containing 100 cc of 70% nitric acid, 94% sulfuric acid and 35% hydrochloric acid, respectively. After exposure to these fumes for 150 hours, the finish on the sample shall show no discoloration, disintegration or other effect.

b. Direct application test: Subject coated samples to the direct action of the following reagents and solvents at a temperature of 25 degrees C dropping from a burette at the rate of 60 drops per minute for ten minutes:

Acetone	
Carbon Tetrachloride	
Ethyl Alcohol	
Glacial Acetic Acid	99.5%
Hydrochloric Acid	38.0%
Mineral Oil	
Nitric Acid	70.0%
Sodium Hydroxide	50.0%
Sulfuric Acid	92.0%
Toluene	
Zinc Chloride-Saturated	

c. Finish on the samples shall not rupture, though slight discoloration or possible softening is permissible.

2. Mar and abrasion resistance: Coating material shall have a pencil hardness of 2H-4H adhesion substantial enough to withstand both direct and reverse impacts of 160-inch pounds. Coating shall have excellent mar resistance and be capable of withstanding scuffing, marring and other ordinary wear.
3. Repairability: Coating material shall be capable of surface repair in the event that a fixture is scratched, or a surface rupture occurs. The service fixture manufacturer shall have available an air-drying aerosol coating, specially formulated to match the existing epoxy coating which may be applied in the field to repair coated surfaces.

E. Water Faucets and Valves:

1. Faucet and valves for water service shall have a renewable unit containing all working components subject to wear, including a replaceable stainless-steel valve seat (and an integral adjustable volume control). The renewable unit shall be broached for position locking in the valve body. The unit shall have a high durometer thermoplastic valve disc and a molder TFE stem packing. The unit shall be capable of being readily converted from compression to self-closing control, and visa versa, without disturbing the faucet body.
2. Goosenecks shall have a separate outlet coupling with a 3/8" IPS female thread securely brazed to the gooseneck for attachment of serrated hose ends, aspirators and other outlet fittings. Rigid goosenecks shall have a 3/8" IPS male inlet thread and be threaded directly into the faucet body so

as to be absolutely rigid. Swing goosenecks shall utilize a double O-ring union-type construction and be convertible from swing to rigid and vice versa.

3. Vacuum breakers: Provide vacuum breakers only at water fixtures where indicated on the lab drawings. At sinks, the vacuum breaker shall be integral with the gooseneck. Vacuum breakers shall have a forged brass body, a renewable seat and an ultralight float cup with a silicone gasket for fine flow control. Vacuum breakers shall not spill over at low water volume. Vacuum breakers shall be certified by the American Society of Sanitary Engineers (ASSE) under Standard 1001.
4. All fixtures for water service shall meet the requirements of ANSI/ASME A112.18.1M-1989 and be certified by the Canadian Standards Association (CSA) under Standard CAN/CSA B.125.M89.
5. Water faucets and valves shall be fully assembled and individually tested at 80 pounds per square inch (PSI) water pressure.
6. Provide hot and cold-water mixing goosenecks with removable aerators, unless otherwise noted. Provide removable serrated hose connectors for cold water fixtures at cup sinks.
7. Provide fixtures as indicated on the Lab Furnishings Drawings.

F. Emergency Shower / Eyewash Devices to be provided by lab furnishings contractor and installed by Div. 22:

1. Fold down activation of eyewash. Eyewash to be plumbed to drain.
2. Stay-open pull handle activation of Emergency Shower.
3. Type 304 stainless-steel cabinet, pull and shower head construction and brushed chrome finish at any exposed piping associated with the shower head.
4. Comply with requirements of ANSI Standard Z358.1 edition as adopted by State of California as well as latest edition of this standard.
5. Emergency Shower/Eyewash units recessed into walls shall have closed back box construction such that the Emergency Shower/Eyewash units do not act as a conduit for air movement that connects the wall cavities to the lab room environment.
6. Provide Watersaver Emergency Retractable Shower Curtain supported from curved stainless steel rod/track.

G. Electrical and Electrical/Telecom Monuments:

1. Laboratory work surface mounted electrical and electrical/telecom monuments along with mounting hardware as required for mounting to lab work surface to be provided by Lab Furnishings Contractor. Installation and devices, coverplates, wiring and other accessories required for complete installation to be provided by Div. 26.
2. Provide bench mounted monuments are manufactured by Watersaver in polished aluminum finish with a clear epoxy coating.

2.2 LABORATORY SINKS

A. Epoxy Resin Sinks: Provide integrally molded epoxy resin sinks as provided by Durcon Incorporated, or equal.

1. Epoxy resin sinks shall be specially compounded modified thermosetting resin and oven cured. Cove inside corners and pitch bottom to threaded drain outlet. Sink size and drain location shall be as shown on drawings.
2. Supply with flange to set in rabbetted opening in epoxy tops for drop-in type application. Provide tail piece and strainer of same material. Sink traps to be provided and installed by Division 22.
3. Sinks to be manufactured such that, when installed, sink edge is dropped into a rabbeted edge in the surrounding epoxy worksurface. There is to be no lip around the sink so liquids on work surface can flow into the sink.
4. Color of epoxy resin sink shall match the color of the surrounding epoxy worksurface in which the sink is installed.

B. Stainless-steel Sinks: Provide one-piece stainless-steel sinks as manufactured by Just Manufacturing, or equal.

1. Lab sinks to be Type 304 Stainless-steel in 18 gage minimum thickness with sound deadening coating on underside.
2. Sinks to have a #4 brushed finish on exposed surfaces.
3. Provide tail piece and strainer of same material. Sink traps to be provided and installed by Division 22.
4. Sinks to be manufactured such that, when installed, there is a nominal ¼" high lip around the sink so spill on work surface does not flow into the sink.

C. Cup Sinks:

1. Epoxy Resin Cup Sinks: Integrally molded from modified thermosetting epoxy resin (in color to match the bench epoxy worksurface in the room that the sink is to be installed), specially compounded and oven cured. Cove inside corners and pitch bottom to threaded drain outlet. Cupsink traps to be furnished and installed by Division 22.

    a. Supply with flange to set in rabbetted opening in epoxy tops.
    b. Provide with perforated strainer and tailpiece. Traps by Division 22.

2. Oval cupsink: 3" x 9" x 6" deep (nom.) with 1/2" radius between sides and bottom.
3. Cup sinks to be manufactured such that, when installed, there is a nominal ¼” high lip around the sink so spill on work surface does not flow into the sink.

PART 3 - EXECUTION

3.1 INSTALLATION OF SINKS

A. Drop-in Epoxy Sink Installation: Set sink into rabbeted edge so sink edge is flush with or slightly lower than surrounding worksurface. Seal between work surface and sink to produce a tight and fully leak-proof joint.

C. Test all lab fixtures for proper fit and function as installed prior to indicating that the project is ready for punchlist.

3.2 REPLACEMENTS AND REPAIRS

A. Replacement: Replace equipment, fixtures, and other components of the work that have been damaged or have deteriorated beyond successful repair.

B. Repairs: Minor damage to finishes may be made using air-drying aerosol coating in matching color, which has been furnished by the manufacturer and is guaranteed to match the original finish in durability and chemical resistance. Repairs and replacement shall meet with the approval of the University's Representative and shall be done at no additional cost to the University.

END OF SECTION

SECTION 12 24 10

ELECTRIC WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide electrically operated window solar shades, with hardware and accessories as required for complete, finished installation.

1.2 REFERENCES

A. NFPA 701: Standard Methods of Fire Tests for Flame-Resistant Textiles and Films.

B. FS CCC-T-191b: Flame Retardancy of Textiles.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

B. Shop Drawings: Show hardware, clearances, and operation of shades with specified system.

1. Layout of openings and control locations subject to Architect approval where not clearly indicated.

C. Samples: Submit samples of each fabric indicating finishing of top, bottom and sides, and section of frame indicating finish.

D. Certificate of Flame Proofing or Flame Resistance: Submit certification, recommendations, and instructions for laundering of specified fabrics and maintenance of entire installation.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide window shades as complete units produced by one manufacturer, including hardware, accessory items, mounting brackets and fastenings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver shades until installation area is ready for shade installation.

B. Number and identify shades as to locations in Project.

1.6 SITE CONDITIONS

A. Before installation, physically measure and inspect space after limiting conditions are established.

1. Note floor and ceiling may not be level.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Mecho Shade Corporation.

B. Lutron Electronics Co.

C. SKYCO Shading Systems, Inc.

D. Substitutions: Refer to Section 01 62 00.

2.2 MATERIALS

A. System Description: Provide electrically operated window shades as indicated, with hardware and accessories.

B. Regulatory Requirements:

1. Flame-Retardant Materials: Approved by California State Fire Marshal's Office.

2. Fire Resistant Fabrics: Required to have passed one of following:

a. CBC/CFC 806.4 Flame resistant in accordance with CCF, Title 19, Division 1, Chapter 8.

b. FS CCC-T-191, test 5903.

C. Electrical Window Shades:

1. Provide electrical shades as complete units produced by one manufacturer, including hardware, accessory items, mounting brackets and fastenings.

2. Motor: Fractional horsepower asynchronous motor with reversible capacitor designed for intermittent operation; thermally protected, totally enclosed.

a. Provide solenoid activated disk brake and internal limit switches which are externally adjustable.

3. Speed: Minimum 12 rpm.

4. Control: Provide separate controls for blackout and solar shades.

a. Solar Shades: Maintained double pole, double throw switch located remotely; each room shall have one switch, multiple shades shall operate simultaneously.

1) Motor logic controllers shall be provided where control of three or more shades is required.

D. Solar Shade Fabrics: Manufacturer’s standard fire-resistant glass cloth fabric; colors and patterns as selected by Architect from manufacturer’s full range.

1. Solar Shades: Manufacturer's standard fire-resistant glass cloth fabric.

2. Colors: As selected by Architect from manufacturer's full range of colors.

E. Shade Pockets: Mount shades as indicated on Drawings, as approved by Architect where not otherwise indicated.

F. Accessories: Provide accessories, brackets, fittings, and fastenings as necessary for proper operation and installation of shades; conceal fasteners or finish flush, painted to match exposed metal finish.

G. Exposed Metal Finish: Manufacturer's standard white painted finish as approved by Architect.

2.3 FABRICATION

A. Center Seams: Use single widths of fabric with no center seams for each shade.

B. Shade Mounting System: Allow for shade removal and replacement without disassembling hardware assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect site conditions prior to installation for conditions that could affect proper installation and operation of shades.

B. Beginning installation signifies acceptance of substrates and conditions.

3.2 INSTALLATION

A. Install shades in accordance with manufacturer's recommendations and installation instructions.

1. Install shades level, plumb, secure, and at proper height; cooperate with other trades for securing shades to substrate and finished surfaces.

B. Hang shades to be straight and even, employing hand sewing of seams and hems as necessary for carefully matched installation with even, horizontal top and bottom hems, and quiet, smoothly operating system.

C. Fabricate and install shades so when open, closed or while operating shades are not abraded by window frame, ceiling, or sill.

3.3 ADJUSTING

A. Thirty days after hanging shades, inspect installation for fabric shrinkage or expansion or other variations and rehang as necessary for conformance to specified tolerances.

END OF SECTION

SECTION 12 35 53

LABORATORY CASEWORK SYSTEM AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. All laboratory casework, work surfaces and other items specified herein and shown on the drawings shall be furnished, installed and shall properly perform in accordance with the functions specified herein. Provide all necessary fillers, scribes and miscellaneous accessories and hardware to provide a complete installation. All laboratory furnishing provided and installed are to be seismically braced as required by the California Building Code. All open shelves, including open front cabinets, are to have high seismic lips which project 1-1/2" above top surface of the shelf in order to restrain stored items from sliding off any open sides of shelves. Seal all joints between new fixed (bolted down) lab furnishings and any adjacent non-lab furnishings materials.

1.2 SECTION INCLUDES

A. Painted Steel Casework.

B. Work Surfaces.

C. Epoxy Dry Racks.

D. Misc. closure panels, knee space panels, scribes, seismic restraints, hardware, etc. as required for complete lab furnishings installation.

E. Plug-in type task light fixtures at underside of lab bottom wall shelves and wall cabinets.

1.3 RELATED SECTIONS

A. Division 5: Cold-Formed Metal Framing: Backing in Walls for Laboratory Casework and Accessory Anchorage.

B. Division 9: Resilient Base Molding.

C. Section 11 53 13: Laboratory Fume Hoods.

D. Section 11 53 43: Laboratory Sinks, Mechanical Fixtures and Electrical Fixtures.

E. Division 22: Plumbing.

F. Division 23: Heating, Ventilating, and Air-Conditioning.

F. Division 26: Electrical.

1.4 REFERENCES

A. ASTM 366 gauges U.S. high quality cold rolled milled steel.

B. SEFA 8 – Metal Casework and Adaptable Systems

1.5 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's data for each item of laboratory furnishings, equipment and accessories. Include component dimensions, configurations, construction details, joint details, utility connections and attachments. Indicate location, size and service requirement for each utility connection.

B. Shop Drawings (all shop drawings must be based on actual dimensions confirmed in project area):

1. Provide 1/2" = 1'-0" scale elevations of individual and battery of casework units showing cross sections, rough-in and anchor placements, tolerances and clearances. Indicate relationship of lab casework units and accessories to fume hoods, biological safety cabinets other laboratory equipment, surrounding walls, windows, doors and other building components. Show the full length of wall for each wall casework elevation. Show all lab casework accessories that LF contractor is providing or installing. Show dimensional locations for all items.
2. Provide 1/4" = 1'0" rough-in plan drawings for coordination with Mechanical, Electrical and Plumbing trades. Rough-in shall show free area.
3. Provide wall backing elevations showing where backing associated with lab furnishings is to be installed by the General Contractor and other associated requirements for the backing.

C. Work Surface Samples: Submit product sample of each type of work surface

D. Hardware Samples: Provide samples of door and drawer pulls, locks and hinges.

E. Finish Samples: Submit 3" x 5" samples of each color of finish for each type of casework and accessories for approval by the University's Representative.

F. Submit detailed seismic anchorage and attachment drawings and calculations stamped and signed by a Structural Engineer licensed in the State of California indicating seismic anchorage design requirements in compliance with the California Building Code.

G. Submittal Procedures and Quantities are specified in Section 01 33 23.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Laboratory casework, work surfaces and accessories specified as part of this section, Section 11 53 43 - Laboratory Sinks, Mechanical and Electrical Fixtures and Section 11 53 13 - Laboratory Fume Hoods shall be furnished by a single laboratory furnishings supplier.

B. The supplier for work in this section shall make use an established manufacturer's production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to complete an installation of this size and type within the required time limits:

1. Ten years or more experience in manufacture of laboratory casework and equipment of type specified.
2. Twenty installations of equal or larger size and requirements within the last five years.

1.7 DELIVERY, STORAGE AND HANDLING

A. Schedule delivery of casework and equipment so that spaces are sufficiently complete to allow for installation immediately following delivery.

B. Protect finished surfaces from soiling or damage during handling and installation. Cover working surfaces with cardboard or other protective covering as required to protect lab furnishings until the project has been turned over to the University.

1.8 PROJECT CONDITIONS

A. Do not deliver products to project area or install until the following conditions have been met:

1. Area is secure and weather tight.
2. Ceiling grid, overhead ductwork, and lighting are installed as required.
3. All painting is completed and finished flooring material is installed.
4. Under no conditions should moisture levels exceed 50% relative humidity.

1.9 WARRANTY

A. Submit manufacturer’ and installer’s Warranty stating that the lab furnishings and equipment provided and installed for this project shall be free from all defects in material, manufacture and installation for a period of two years and that the lab furnishings contractor shall make corrections if defects in the lab furnishings or equipment are discovered.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Performance Requirements:

1. Structural requirements:

a. Maximum individual component load ratings:

1)	Adjustable-height tables	600 lbs.
2)	Fixed-height tables	600 lbs.
3)	Mobile tables	300 lbs.
4)	Cantilevered work surfaces (when mounted on cores or on wall-mounted panels)	600 labs.
5)	Cantilevered work surfaces (all other applications Including Wall Rail System)	400 lbs.
6)	Top of core	180 lbs.
7)	Top of reagent rack	180 lbs.
8)	Suspended cabinet	300 lbs.
9)	Floor-mounted cabinets (per lineal foot)	500 lbs.
10)	Drawers in cabinets (each)	150 lbs.
11)	Hanging upper storage cabinets	300 lbs.
12)	Shelves:	
	6" 8", and12" deep	180 lbs.
	15” deep	180 lbs.
	18" deep	130 lbs.
	24" deep	100 lbs.
13)	Pull board	25 lbs.

2. Metal finish and finish performance:

a. Metal Finish:

1) Preparation: Spray clean metal with a heated cleaner/phosphate solution, pretreat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.

1) Application: Electrostatically apply powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high-grade laboratory furniture quality finish of the following thicknesses:

a) Exterior and interior surfaces exposed to view: 1.5 mil average and 1.2 mil minimum.
b) Backs of cabinets and other surfaces not exposed to view: 1.0 mil average.

3) Finish drawer bodies in matching or harmonizing color and apply corrosion-resistant treatment to selected, concealed interior parts.

b. Metal finish performance requirements:

1) Abrasion resistance: Maximum weight loss of 5.5 mg. per 100 cycle when tested on a Taber Abrasion Tester #E40101 with 1000 gm wheel pressure and Calibrate #CS10 wheel.
2) Hardness: Surface hardness equivalent to 4H or 5H pencil.
3) Humidity resistance: Withstand 1000-hour exposure in saturated humidity at 100 degrees F.
4) Moisture resistance:

   a) No visible effect to surface finish after boiling water trickled over test panel inclined at 45 degrees for five minutes.
   b) No visible effect to surface finishes following 100-hour continuous application of a water-soaked cellulose sponge, maintained in a wet condition throughout the test period.

c. Chemical resistance:

1) Test procedure: Apply 10 drops (approximately 0.5 cc) of each reagent identified on the surface of the finished test panels laid flat and level on a horizontal surface. Ambient temperature: 68-72 degrees F (20-22 degrees C). After one-hour flush away chemicals with cold water and wash surface with detergent and warm water at 140 degrees F (65.5 degrees C) and with alcohol to remove surface stains. Examine surface under 100-foot candles of illumination.
2) Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

   a) No effect: No detectable change in surface material.
   b) Excellent: Slight detectable change in color or gloss, but no change to the function or life of the working surface material.
   c) Good: A clearly discernable change in color or gloss, but no significant impairment of working surface function or life.
   d) Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period of time.
   e) Failure: Pitting, cratering or erosion of worksurface material. Obvious and significant deterioration.

3) Minimum acceptable results (concentration by weight):

CHEMICAL	RATING
Acetic Acid, 93%	Excellent
Formic Acid, 33%	Good
Hydrochloric Acid, 37%	Excellent
Nitric Acid, 25%	Excellent

Nitric Acid, 60%	Good
Phosphoric Acid, 75%	Excellent
Sulfuric Acid, 28%	Excellent
Sulfuric Acid, 85%	Excellent
Ammonium Hydroxide, 10%	Excellent
Sodium Hydroxide, 10%	Excellent
Sodium Hydroxide, 25%	Excellent
Acetone	Excellent
Carbon Tetrachloride	Excellent
Ethyl Acetate	Excellent
Ethyl Alcohol	Excellent
Ethyl Ether	Excellent
Formaldehyde, 37%	Excellent
Hydrogen Peroxide, 5%	Excellent
Methylethyl Ketone	Excellent
Phenol, 85%	Good
Xylene	Excellent

2.2 STEEL LABORATORY CASEWORK

A. Manufacturer:

1. Design of steel laboratory casework is based on products manufactured by Mott Manufacturing. Kewaunee or approved equal products are also acceptable providing they meet the project requirements. All casework shall be the product of one manufacturer.

B. Design Requirements:

1. Full flush overlay construction: Provide Mott “Architectural Overlay”, Kewaunee “Overlay Square Edge”, or approved equal.
2. Cabinet doors and drawer fronts to fully cover front of cabinet.
3. Self-supporting units: Completely welded shell assembly without applied panels at ends, backs or bottoms, so that cases can be used interchangeably or as a single, stand-alone unit.
4. Interior of case units: Easily cleanable, flush interior. Base cabinets, 30" and wider, with double swinging doors shall provide full access to complete interior without center vertical post.
5. Drawers: Sized on a modular basis for interchange to meet varying storage needs and designed to be easily removable in field without the use of special tools.
6. Provide floor standing and suspended base cabinets as required on the drawings.

C. Performance Requirements:

1. Structural performance requirements: Casework components shall withstand the following minimum loads without damage to the component or to the casework operation:

a. Steel base unit load capacity: 500 lbs. per lineal foot.

b. Suspended units: 300 lbs.
c. Drawers in a cabinet: 150 lbs.
d. Utility tables (4 legged): 600 lbs.
e. Hanging wall cases: 300 lbs.
f. Load capacity for shelves of base units, wall cases and tall cases: 180 lbs.

D. Materials and Finishes:

1. Sheet steel: Mild, cold rolled and leveled unfinished steel.
2. Minimum gauges:

a. 20-gauge: Solid door interior panels, drawer fronts, scribing strips, filler panels, enclosures, drawer bodies, shelves, security panels and sloping tops.
b. 18-gauge: Case tops, ends, bottoms, bases, backs, vertical posts, uprights, glazed door members, door exterior panels and access panels.
c. 16-gauge: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
d. 14-gauge: Drawer suspensions, door and case hinge reinforcements and front corner reinforcements.
e. 11-gauge: Table leg corner brackets and gussets for leveling screws.

3. Glass:

a. 3mm nominal 3/32" clear float tempered
b. 6mm, nominal 7/13" clear float tempered
c. Glass to be without imperfections or marred surfaces.

4. Metal finish: Refer to 2.2, 2 Metal Finish in this specification section.

E. Construction:

1. Base Units and Cases:

a. Base units and 25", 31" and 37 " high wall cases: End panels and back, reinforced with internal reinforcing front and rear posts.
b. 49" and 84" high cases: Formed end panels with front and rear reinforcing post channels; back shall be formed steel panel, recessed 3/4" for mounting purposes.
c. Posts: Front post fully closed with full height reinforcing upright. Shelf adjustment holes in front and rear posts shall be perfectly aligned for level setting, adjustable to 1/2" o.c.
d. Provide gusset reinforcement at front corners.
e. Base unit backs: Provide drawer units without backs and cupboard units with removable backs.
f. Bottoms: Base units and wall cases shall have one-piece bottom with front edge formed into front rail, rabbeted as required for swinging doors and drawers and flush design for sliding doors.
g. Top rail for base units: Flush with front of unit.

h. Horizontal intermediate rails: Recessed behind doors and drawer fronts; removable for later revision in cabinet configuration.
i. Base for base units: 4" high x 3" deep with formed steel base and 11-gauge die formed steel gussets at corners. Provide 3/8" diameter leveling screw with integral bottom flange of minimum 0.56 sq. in. area at each corner, accessible through openings in toe space.
j. Tops of wall cases: One piece, with front edge formed into front rail.

2. Drawers:

a. Drawer fronts: 3/4" thick, double wall construction, pre-painted prior to assembly and sound deadened; top front corners welded and ground smooth.
b. Drawer bodies: Bottom and sides formed into one-piece center section with bottom and sides coved and formed top edges. Front and back panels spot-welded to center section.
c. Drawer suspension: Heavy duty coved raceways for both case and drawer with nylon tired, ball bearing rollers; self-centering and self-closing when open to within 5" of the closed position.
d. Provide drawer with rubber bumpers. Friction centering devices are not acceptable.
e. Drawer slides: Provide full extension slides with minimum 50 pounds live load per drawer capacity.

3. Doors:

a. Solid panel doors: 3/4" thick, double wall, telescoping box steel construction with interior pre-painted and sound deadened, all outer corners welded and ground smooth. Reinforce interior of front panel with welded steel hat channels. Secure hinges with screws to internal 14-gauge reinforcing in case and door. Hinges shall be removable and welding of hinges is not acceptable. Doors shall close against rubber bumpers.

4. Shelves:

a. Form front and back edges down and back 3/4". Form ends down 3/4".
b. Reinforce shelves over 36" long with welded hat channel reinforcement the full width of shelf.
c. Pull out shelves: Same suspension as specified for drawers.
d. All base cabinet shelves are to be full depth.

5. Hardware:

a. Drawer and hinged door pulls: Provide Type 304 stainless-steel wire pulls at all metal lab casework unless otherwise noted.
b. Hinges: Institutional type, five knuckle projecting barrel hinges, minimum 2-1/2" long, type 302 or 304 stainless-steel. Provide two hinges for doors up to 36" high; three hinges for doors over 36" high. Drill each leaf for three screw attachment to door and frame.

c. Door catches: Positive catch with two-piece heavy-duty cam action. Main body of catch shall be confined within an integral cabinet top or divider rail, while latching post shall be mounted on the hinge side of the door. Or adjustable type, spring actuated nylon roller catches.

d. Elbow catches: Spring type of cadmium plated steel, with strike of suitable design (only provide elbow catches at lockable cabinets with double doors)

F. Locks: Provide only where indicated on the drawings

1. 5-pin tumbler for grand master key system.

a. Grand Master Key System: Grand master key system shall have 5-pin tumbler locks with capacity for 2000 primary key changes. Master key one level with built-in flexibility to accommodate, if required, 3 levels: 1 Grand master, 59 Master groups and 70 Sub-master groups with 13 primary key changes under each.

b. Keys: Stamped brass available from manufacturer or local locksmith, and supplied in the following quantities unless otherwise specified:
2 for each keyed different lock
3 for each group keyed alike locks
2 for master keys for each system

2. Locks to have heavy-duty cylinders. Exposed lock nose finish to be dull nickel (satin) plated. Provide locks by National or equal.

3. Provide keying as requested by University.

2.3 WORK SURFACES

A. Epoxy Resin:

1. Material: Chemically and abrasion resistant, durable top of 1" thick cast material of epoxy resins and inert products, cast flat, with a uniform low-sheen surface. Lab work surfaces to be white in color. Provide Durcon Alpine White color, or equal.

2. Backsplash and sidesplash curbs: Same material as work surface, 4" high: Provide and at all edges of work surfaces which are adjacent to vertical surface of walls, fume hoods, tall cabinets, etc. Provide backsplash around all penetrations through lab tops and around all vertical support structures and around all service drop enclosures.

a. Butt jointed and cemented to top with black silicone. Include end curb where top abuts end wall.

3. Marine Edges: Provide Marine edges to contain spills on worksurfaces where indicated on the drawings.

4. Test Results - Epoxy Resin Work Surface:

REAGENT	RATING

Hydrochloric Acid 37%	Excellent
Sulfuric Acid 33%	No Effect
Sulfuric Acid 77%	No Effect
Sulfuric Acid 96%	Failure
Formic Acid 90%	Excellent
Nitric Acid 20%	Excellent
Nitric Acid 30%	Excellent
Nitric Acid 70%	Good
Hydrofluoric Acid 48%	Fair
Phosphoric Acid 85%	No Effect
Chromic Acid 60%	Failure
Acetic Acid 98%	Excellent
3 & 8 Equal Parts	Excellent
Ammonium Hydroxide 28%	No Effect
Sodium Hydroxide 10%	No Effect
Sodium Hydroxide 20%	No Effect
Sodium Hydroxide 40%	No Effect
Sodium Hydroxide Flake	No Effect
Sodium Sulfide	Excellent
Zinc Chloride	No Effect
Tincture of Iodine	Excellent
Silver Nitrate	No Effect
Methyl Alcohol	No Effect
Ethyl Alcohol	No Effect
Butyl Alcohol	No Effect
Benzene	Excellent
Xylene	No Effect
Toluene	Excellent
Gasoline	No Effect
Dichlor Acetic Acid	Good
Di Methyl Formamide	Excellent
Ethyl Acetate	No Effect
Amyl Acetate	Excellent
Acetone	Excellent
Chloroform	Excellent
Carbon Tetrachloride	No Effect
Phenol	Excellent
Cresol	Excellent
Formaldehyde	No Effect
Trichlorethylene	Excellent
Ethyl Ether	Excellent
Furfural	Good
Methylene Chloride	Excellent
Mono Chlor Benzene	Good
Dioxane	Excellent
Methyl Ethyl Ketone	Excellent
Acid Dichromate	Fair
Hydrogen Peroxide	No Effect
Naphthalene	Excellent

2.4 ACCESSORIES

A. Epoxy Drying Racks:

1. Construction: Epoxy resin board finished on all exposed surfaces.
2. Pegs: White polypropylene two prong injection molded pegs with glassware protector base. Do not bond pegs to board.
3. Drip trough: 16-gauge, Type 304 stainless-steel drip trough with drain tube and clear drain hose into sink. Stainless-steel trough ends shall be welded to form a watertight seal.
4. Epoxy drying racks to be white epoxy color to match lab work surfaces.

B. Task Light Fixtures

1. Provide plug-in type Hero Task Light by Mocha Lighting, or approved equal, Task light shall be only .6” high (top to bottom) and be magnetically attached to underside of metal wall cabinets where indicated on the laboratory plan.
2. Provide 22” nominal length for each 30” wall cabinet, 31” nominal length task light for each 36” wall cabinet and 40” nominal length task light for each 48” wall cabinet.
3. Task lights to have an integrated power supply without external power adaptor.
4. Task lights to have an integral infrared proximity sensor, manual on-off switch. Task lights are to be manually turned on and to turn off after a determined, adjustable time period when no motion is sensed.
5. Light fixture color to be selected by University’s representative from manufacturer’s standard color options. At minimum, a white and silver color option is to be available.
6. Task lights on cabinets on a given wall are to be daisy chained for power but are to be individually controllable for on/off operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Casework Installation:

1. Install lab furnishings system over finished lab flooring and in strict accordance with manufacturer’s instructions. Lab finish flooring to extend “wall-to-wall” in all lab rooms.
2. Set system components plumb, square, and straight with no distortion and securely anchored to building structure. Shim as required using concealed shims.
3. Install lab furnishings over finished flooring after finished flooring is installed.
4. All lab furnishings shall be seismically braced per California Building Code requirements. Lab furnishings shall be seismically braced per seismic calculations and details submitted in Lab Furnishing Submittal (See paragraph 1.6 of this section.)

a) Lab furnishings at wall conditions shall be braced to wall backing or studs in walls.

B. Work Surface Installation:

1. Where required due to field conditions and worksurface material, scribe to abutting surfaces.
2. Only factory prepared field joints, located per approved shop drawings, shall be permitted. Secure joints in field, where practical, in the same manner as in factory, with dowels, splines, adhesive or fasteners recommended by manufacturer.
3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
4. Abut top edge surfaces in one true plane. Provide flush joints. Not to exceed 1/8" between top units.
5. Joints between adjoining epoxy lab worksurfaces at Flexible Lab Furnishings System Modules are to be sealed with silicone sealant so as

   to provide a reasonable degree of spill control while maintaining the ability to easily reconfigure the lab furnishings system components. Joints between epoxy panels over fixed lab casework may be sealed with epoxy sealant. Joints around 4 leg tables are not to be sealed.

C. Accessory Installation: Install accessories and fittings in accordance with manufacturer's recommendations. Turn screws to seat flat; do not drive.

3.2 ADJUSTING

A. Repair or remove and replace defective work, as directed by University's Representative upon completion of installation.

B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.3 CLEANING

A. Clean shop finished casework, touch up as required, wipe down and broom clean interior and exterior of equipment.

3.4 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of casework and equipment from exposure to other construction activity during installation.

B. Advise contractor of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

END OF SECTION

SECTION 12 36 61

SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

B. Related Requirements:

1. Section 22 00 00 "Plumbing" for sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size solid surface material countertop, with front edge, 6 by 6 inches, of construction and in configuration specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Basis of Design: ChemTops epoxy resin countertops.
   b. Equivalent product of other manufacturers approved by the Architect.
2. Colors and Patterns: Lunar White.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium .

B. Countertops:

1. 1-inch- thick, solid surface material .

C. Backsplashes: 3/4-inch- thick, solid surface material.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Install integral sink bowls in countertops in the shop.

E. Joints:

1. Fabricate countertops in sections for joining in field.
   a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
   b. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 90 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 07 90 00 "Joint Sealants."

END OF SECTION

SECTION 12 48 15

RECESSED ENTRY GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide stainless-steel recessed entry grilles with flush frames and accessories as required for complete installation.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

B. Shop Drawings: Include large scale drawing of recessed entry grille system.

1. Provide templates or frames to job site in time for installation in subflooring.

C. Samples: Submit sample of grille and section of frame.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. Kadee Metafab/SSS Clean Tread.

B. Pawling Corp./RG-700 Series.

C. Babcock-Davis/proGRIL Stainless Steel Grate.

D. Construction Specialties, Inc./GridLine 2 G6P.

A. Substitutions: Refer to Section 01 25 00.

2.2 MATERIALS

A. System Description: Provide stainless-steel recessed entry grilles with flush frames and accessories as required for complete installation.

B. Entry Grille: 5/8" thick stainless-steel recessed entry grille with maximum grille opening width of 0.125"; grille sections to be designed with wider top surface than bottom surface to avoid sand from becoming trapped in grille.

C. Recessed Frame: Manufacturer's standard satin finished stainless-steel frame to match grille.

D. Primer: Manufacturer's standard zinc chromate primer or similar protective coating for surfaces in contact with concrete.

E. Anchors and Accessories: Stainless-steel; types as recommended by manufacturer and as required for complete, secured installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install frame in accordance with manufacturer's instructions and approved shop drawings; set to allow entry grilles to be flush with adjacent finish floor.

B. Install entry grilles level and true to line, flush with adjacent finished floor surfaces.

C. Anchor grilles to frame with devices spaced as recommended by manufacturer.

END OF SECTION

SECTION 21 00 00

FIRE SUPPRESSION

PART 1 - GENERAL

1.01 INCLUSION OF GENERAL CONDITIONS AND GENERAL REQUIREMENTS

A. The Bidding Requirements, Contract Forms, General Conditions, Supplemental General Conditions, Division 01 - General Requirements are a part of this Section and the Contract for this work and apply to this Section as fully as if repeated herein.

1.02 SUMMARY

A. Furnish and install complete wet-pipe fire sprinkler system as specified in Contract Documents. The fire sprinkler system shall be a wet pipe type sprinkler system. The system shall be installed in conformance with the current Edition of NFPA 13, Standard for Installation of Sprinkler Systems as amended in CBC 2013, Chapter 35. All materials utilized shall be UL Listed and Factory Mutual Approved. All materials installed shall adhere to the manufacturer's installation guidelines.

B. Scope includes all design, labor, equipment, materials, tools, transportation, excavation and backfill, supervision, and services required to furnish and install a complete and properly operating engineered wet-pipe fire protection system. Wet-pipe fire protection system shall be installed in all areas of the buildings.

C. Should any work or materials be not included in the Drawings or Specifications but is nevertheless necessary for the proper execution of the stated scope thereof or for full compliance with governing authorities, the Contractor shall understand such work and/or materials is required and shall perform all such work and furnish such material as fully as if it were particularly delineated or described.

1.03 REFERENCES

A. American Society For Testing And Materials

1. ASTM A 53, "Standard Specification for Pipe, Steel and Hot-Dipped, Zinc-Coated, Welded and Seamless"

2. ASTM A 234, "Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature Service"

B. American National Standards Institute / American Society of Mechanical Engineers

1. ANSI / ASME B 16.1, "Cast Iron Pipe Flanges and Pipe Flanged Fittings"

2. ANSI / ASME B 16.4, "Cast Iron Threaded Fittings, Class 125 and Class 250"

C. National Fire Protection Association

1. / NFPA 13-2013, “Installation of Sprinkler Systems” as amended in CBC 2013, Chapter 35.

1.04 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Automatic fire alarm system devices - see Division 26 for electrical requirements.

1.05 DESIGN WET-PIPE SPRINKLER SYSTEM

A. The wet-pipe sprinkler system design shall be for a light hazard occupancy classification. Occupancy classifications shall be verified with the State Fire Marshal.

B. Design of the sprinkler system shall be based on total hydraulic balance to attain uniform density of spray, i.e. the pressure drop from point of connection to any one sprinkler head shall be just sufficient to produce the density of flow required for that head. Tolerances shall be as follows:

1. +10%, -0% flow for most remote sprinkler in any area of application (remote or intermediate).

2. + or - 10% flow for any other sprinkler, but in no case shall total flow for any area of application be less than specified density requirement.

C. Calculations shall include:

1. Pressure at every juncture from the remote locations to the source.

2. Demand flow rate (GPM) through the point of connection to the main water supply.

3. Demand GPM through the point of connection to the public utility main in the street.

4. Simulated water flow at main riser.

5. Main and branch pipe sizes.

6. Minimum flow pressure at every sprinkler shall be 7 PSIG.

D. Sprinkler spacing shall not exceed the limits allowed in NFPA 13.

1.06 SUBMITTALS

A. All submittals shall be submitted under the provisions of Section 01 3300 - Submittal Procedures and as follows:

1. Product Data
   a. Submit manufacturer’s product data for all fire sprinkler system components, in compliance with specifications.

2. Shop Drawings.
   a. Prepare shop drawings of complete Fire Sprinkler systems and submit to Architect for approval prior to fabrication or installation of any work.

b. Obtain all necessary information regarding layout of piping, conduit, ductwork, lights and air outlets, etc., and place piping and sprinkler heads to avoid interferences. Head layout shall be symmetrical.

c. After award of Contract and prior to purchase of equipment, submit seven sets of shop drawings with specifications and hydraulic calculations to Architect and two sets to local jurisdiction having authority for fire prevention for review. Check shop drawings before forwarding to Architect, and ascertain that submittals meet all requirements of drawings and specifications, and conform to space conditions.

d. After integrating Architect's and local jurisdiction's comments into drawings, the fire protection engineer of record submitting fire sprinkler system design construction documents shall stamp, sign, and date each sheet of shop drawings and first page of specifications and calculations.

e. Submit stamped documents to area office and local jurisdiction having authority for fire prevention for final approval. After final approval, submit four copies of approved stamped documents to Architect.

f. Failure of system to meet requirements of authority having jurisdiction shall be corrected at no additional cost to Owner.

3. Hydraulic Calculations & Test Data

   a. Calculations as indicated in paragraph above.

4. Operation And Maintenance Data (Refer to Contract Closeout for additional O&M Manual Requirements)

   a. Provide master index showing items included.

   b. Provide name, address, and phone number of Architect, Architect's Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.

   c. Provide operating instructions to include general description of fire protection system and step-by-step procedure to follow in putting system into operation.

   d. Maintenance instructions shall include a list of system components used indicating name and model of each item and manufacturer's maintenance instructions for each component installed in Project. Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.

   e. Include copies of approved shop drawings and copies of required warranties.

1.07 QUALITY CONTROL

A. Qualifications:

1. A State of California Licensed C-16 Contractor shall install all fire sprinkler system components, including underground lines and overhead lines. Furnish verified list of similar projects installed during past 5 years.

B. Requirements of Regulatory Agencies

1. Unless noted otherwise, system shall conform to:

a. ANSI / NFPA 13 , 2013 - “Light & Ordinary Hazard Occupancies”

b. ANSI / NFPA 24 , 2013 - “Service Mains and Their Appurtenances, Private”

c. Requirements of local water department and local authority having jurisdiction over fire protection.

d. Applicable rules, regulations, laws, and ordinances.

2. Comply with backflow prevention requirements and if required, include device in hydraulic calculations.

PART 2 - PRODUCTS

2.01 GENERAL

A. Only specified materials shall be utilized in the work of this Section unless substitutions have been approved by the State Fire Marshal and the Architect, and in accordance with Section 01 6200.

2.02 COMPONENTS

A. Pipe

1. Above Grade: Schedule 10 sprinkler pipe with ABF protection, or Allied “Dyna Flow” and “Dyna Thread” pipe with Schedule 40 sway brace piping.

a. 2" and smaller: Welded, threaded, flanged, soldered, or roll grooved coupling system.

b. 2-½" and larger: Welded, flanged, or roll grooved coupling system.

2. Below Grade: Cast iron, hub or mechanical joint. Install thrust blocks at all fittings.

3. Piping and fittings used for the installation of underground water mains shall be listed for such service.

B. Fittings

1. Screwed: Cast/Ductile iron meeting requirements of ANSI B 16.4, Anvil, Victaulic or approved equal.

2. Flanged: Cast/Ductile iron meeting requirements of ANSI B 16.1. Anvil, Victaulic or approved equal.

3. Welded: Carbon steel meeting requirements of ASTM A 234.

4. Roll grooved pipe coupling system. Victaulic Firelock system or approved equal.

5. Flexible Sprinkler Hose Fittings: Flexhead Industries.

C. Valves

1. Butterfly Valves
   a. UL / FM approved
   b. Grooved end, with supervisory tamper switch; Tyco BFV-N or approved equal
2. Globe Valves
   a. UL / FM approved
   b. WWP Bronze, threaded ends, screw over bonnet; Nibco KT-65-UL or approved equal
3. Gate Valves
   a. UL / FM approved.
   b. Outside Screw and Yoke Type (OS&Y) Class 150 psi, flanged ends.; Nibco F-637-31, Mueller A-2073-6, or approved equal
4. Ball Valves
   a. UL / FM approved, valve tamper switch
   b. Threaded ends: Nibco KT-505, Milwaukee BBSC, or approved equal
   c. Grooved ends: Nibco KG-505, or approved equal.
5. Check Valves
   a. UL / FM approved
   b. 2” - 12”, Tyco Model CV-1F

D. Sprinklers: Pendent and Concealed Pendent, Horizontal Sidewall, Upright and Conventional:

1. Tyco, Series TY-FRB - 5.6 K-factor Horizontal and Vertical Sidewall Sprinklers, Quick Response, Standard Coverage
2. Tyco, Series TY-FRB - 2.8, 4.2, 5.6 & 8.0 K-factor Upright, Pendent, and Recessed Pendent Sprinklers, Quick Response, Standard Coverage

E. Pressure Gauges

1. Mechanical water pressure gauges:
   a. UL / FM approved
   b. 0 to 300 psi, Viking VWATERSF, Reliable, Trerice or approved equal.

F. Post Indicator - See Civil Drawings

G. Fire Department Connection - See Civil Drawings

H. Hangers and Supports

1. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in

NFPA 13, Standard for Installation of Sprinkler Systems. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application. Hangers or supports not specifically listed for service shall be designed and bear the seal of a professional engineer. All hangers and supports shall be manufactured by Tolco Hanger Company or approved equal.

I. Test and Drain Valves

1. UL/FM approved, single handle, tamper resistant, with UL/FM pressure relief valve.

2. AGF Manufacturing model 1011A TestanDrain 300 psi bronze ball valves or approved equal. The valve shall include a tamper resistant test orifice and integral tamper resistant sight glasses. The orifice size shall be noted on the indicator plate and the valve shall feature a tapped and plugged port for system access.

J. Waterflow Detectors

1. System Sensor “WFD” series valve-type waterflow detectors, or approved equal, shall be installed on system piping as designated on the Drawings and/or as specified herein. Detectors shall mount on any clear pipe span of the appropriate nominal size, either a vertical upflow or horizontal run, at least 6” from any fittings which may change water direction, flow rate, or pipe diameter or no closer than 24” from a valve or drain. Detectors shall have a sensitivity in the range of 4 to 10 gallons per minute and a static pressure rating of 450 psi for 2” - 8” pipes. The detector shall respond to waterflow in the specified direction after a preset time delay, which shall be field adjustable. The delay mechanism shall be a sealed mechanical pneumatic unit with visual indication of actuation. The actuation mechanism shall include a polyethylene vane inserted through a hole in the pipe and connected by a mechanical linkage to the delay mechanism. Outputs shall consist of dual SPDT switches. Two conduit entrances for standard fittings of commonly used electrical conduit shall be provided on the detectors. A grounding provision shall be provided. Unless noted, enclosures shall be NEMA 4 listed by Underwriters Laboratories Inc. All detectors shall be listed by Underwriters Laboratories Inc. for indoor or outdoor use.

2.03 MISCELLANEOUS

A. Provide all necessary escutcheons, drains, test valves and accessories, hose connections for flow test, spare parts, tools and signs that are required for the work of this Section.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Drawings

1. Fire Protection Drawings show general arrangement of piping. Follow as closely as actual building construction and work of other trades will permit.

2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. Plumbing drainage piping and ductwork shall have the right of way over fire protection piping except for fire protection drainage piping wherever conflicts exist. Fire protection piping shall be offset or rerouted as directed at no additional cost to the Owner. These Drawings take precedence over Fire Protection Drawings.
3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

3.02 INSTALLATION

A. Follow general piping installation requirements specified in Section 23 0500 - General Mechanical, and in accordance with NFPA 13.

B. Connect system to flange provided under Division 33.

C. Install system to drain. Drain trapped piping in accordance with NFPA 13.

1. Install main drain from riser.
2. Install auxiliary drains in low points of piping system and inspector's test valve drain to mechanical pad located outside building unless otherwise directed by Architect.

D. Install piping system so it will not be exposed to freezing temperatures.

E. Do not use dropped, damaged, or used sprinkler heads.

F. Install sprinkler lines above ceiling and within walls so that no piping is visible within the building. Where possible, pipes shall be concealed and run parallel to buildings lines.

G. Install tamper switches and pressure flow detectors in locations approved by Architect.

H. Brace and support system to meet seismic zone requirements for building site.

I. All concealed spaces shall be protected by sprinklers except areas not required by NFPA 13.

3.03 FIELD QUALITY CONTROL

A. This Contractor shall not allow or cause any work of this Section to be covered or enclosed until it has been inspected, tested, and approved by the Architect and the authorities having jurisdiction over the Work. Certificates of approval shall be furnished to the Owner. Should any of this work be enclosed or covered up before such inspection, testing, and approval, this Contractor shall uncover the work, have the necessary inspections, tests, and approvals made and, at no expense to the Owner, make all repairs necessary to restore both his work and that of other contractors which may have been damaged to be in conformity with the Contract Documents.

B. Site Tests

1. Test system according to 'Contractor's Material And Testing certificate for Above Ground Piping' NFPA-13.
2. Tests shall be witnessed by Architect and representative of local jurisdiction over fire prevention.
3. Test blanks shall have red painted lugs protruding beyond flange to clearly indicate their presence and be numbered to assure their removal when testing is completed.

C. This Contractor shall make all tests required by all local, state, and federal laws, codes, ordinances, and regulations having jurisdiction over this work.

D. Furnish all necessary labor, materials, and equipment for conducting tests, and pay all expenses in connection therewith. Should leaks develop while testing, repairs shall be made, and tests shall be repeated until a satisfactory test result is obtained.

E. At time of final inspection of the fire sprinkler system, the installing contractor shall provide to the school district,

1. All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed,
2. A copy of NFPA 25, 2023, California Edition, and,
3. A copy of CCR Title 19, Chapter 5 “Fire Extinguishing Systems”.

3.04 SUPPLEMENTARY FIRE PROTECTION REQUIREMENTS

A. Before bidding, be familiar with rulings of governing authorities and comply with such requirements.

B. Protect unattended openings in piping from dirt and vandalism during construction.

C. Insure that joints do not occur in piping installed in pipe sleeves.

D. Where construction is not inherently accessible, provide adequately sized and conveniently located access doors in ceilings, walls and furring for servicing valves, equipment, etc. Doors shall be delivered to the General Contractor for installation. Doors shall be Milcor, Zurn, or as specified under Division 8 Sections. Add doors to have optional keyed latch.

1. Plaster surfaces: Style K
2. Acoustic tile, gypsum board and tackboard surfaces: Style A
3. Masonry surfaces: Style M
4. Rated ceiling and walls: Style “Fire Rated”.

E. Pipe penetrations at finished surfaces shall be covered with chrome plated escutcheon plates with set screws.

F. Install materials and equipment to allow convenient servicing (e.g., no piping in front of

manholes, heaters, controls, electrical equipment, pumps, etc.).

G. Where pipes, etc., pass through roofs or outside wall above grade, provide flashings with weather-tight installation. Where not otherwise specified or shown, flashings shall be 24-gauge minimum thickness galvanized steel, with 8" minimum flange all around and 8" minimum height.

H. Sprinkler heads shall be located in center of ceiling tile.

I. Exposed sprinkler pipe in stairways shall be bent to suit overhead contours (no offset fittings shall be used for this purpose).

J. Connections from branches or mains to sprinkler heads shall be off of the top of branch or main pipe with return bend or piping for adjustment of location.

K. All exterior walkways between and adjacent to the buildings shall be sprinkled.

3.05 OWNER'S INSTRUCTIONS

A. Instruct building maintenance personnel in operation and maintenance of system, utilizing Operation and Maintenance manual when so doing. Minimum instruction period shall be 4 hours.

B. Instruction periods shall occur after Substantial Completion inspection, when system is properly working, and before final payment is made.

3.06 MAINTENANCE

A. Furnish valve wrenches and operating and maintenance instructions to Owner upon completion of work.

B. Furnish twelve spare heads of each type and temperature rating used, properly boxed with sprinkler head wrench.

3.07 MICROBIOLOGICALLY INFLUENCED CORROSION (M.I.C.)

A. All water used to charge or test the fire sprinkler system shall be treated to prevent M.I.C. in accordance with NFPA-13, 2013.

B. Alternately, piping coated with ABF (Allied Tube) may be used in lieu of treatment if acceptable to the local and state Fire Marshal.

END OF SECTION

DIVISION 22 00 00

PLUMBING

1. GENERAL

1.1 SCOPE

A. The work in this section includes, but is not limited to, providing all plumbing work as shown and noted on the plumbing Drawings and Specifications, including the following items:

1. Plumbing fixtures, equipment and piping.
2. Sanitary & lab waste and vent system to five feet from the building.
3. Domestic hot and cold water distribution to five feet from the building.
4. Service water heating and distribution.
5. Cleaning, sterilization and testing for work in this section.
6. Fuel gas distribution.
7. Roof drains and storm drainage piping to five feet from the building.
8. Flues and combustion air piping (PVC) for water heating equipment.
9. Condensate drains from mechanical equipment.
10. Pipe hangers and supports.
11. Pipe insulation.
12. Piping markers and equipment nameplates.
13. Energy code testing, adjusting and reporting.
14. Commissioning of plumbing.

B. Work of other sections, includes the following:

1. All trenching and backfilling associated with the plumbing installation.
2. Site piping and utilities beyond five feet from the building.
3. Fire protection systems.
4. Wastewater treatment and disposal systems.
5. Water supply system including tanks and pumps.
6. Line voltage wiring and disconnect switches. The Electrical Contractor will provide all line voltage wiring & conduit, disconnect switches & magnetic starters (except those furnished under this Section as a part of equipment).
7. Commissioning of mechanical systems.

1.2 CODES AND STANDARDS

A. All work and materials shall be in full accordance with the latest adopted edition of the following documents:

1. 2022 California Building Code (CBC)
2. 2022 California Plumbing Code (CPC)
3. 2022 California Mechanical Code (CMC)
4. 2022 California Electrical Code (CEC)
5. 2022 California Fire Code (CFC)
6. 2022 California Energy Code (Title 24)
7. 2022 California Green Building Code (CALGreen)
8. National Electric Code (NEC)
9. Americans with Disabilities Act (ADA)
10. National Fire Protection Association (NFPA)
11. Local codes and ordinances

B. Accessible (ADA) plumbing fixtures shall comply with all of the accessibility requirements of CBC Chapters 11A and 11B and Federal ADA requirements.

C. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity takes precedence.

D. All potable water system components, devices, materials, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with the current editions of the Safe Drinking Water Act (SDWA), NSF 61, NSF 372 & California AB1953. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61 & California AB1953.

1.3 DRAWINGS AND SPECIFICATIONS

A. Where a conflict exists between Drawings and Specifications, promptly notify the Architect for interpretation and resolution. The most stringent requirements shall be used for bid.

1.4 PERMITS AND FEES

A. The Contractor shall obtain all permits, licenses and fees that are required to perform the work. Provide the Architect with the original certificates, permits, licenses, and receipts for fees.

1.5 SUBMITTALS

A. Provide complete product submittals and shop drawings in electronic format (PDF), as one complete package, prior to commencing work or prior to ordering any materials. **Piecemealed product submittals may be rejected.** Clearly identify/mark each submittal in detail. Note what differences, if any, exist between the submitted Item and the specified Item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings. Items, other than those specified, will not be allowed unless they are approved in writing via the submittal process. Include cut sheets and drawings for the following items in the submittal:

1. All plumbing components, including pipe hangers, pipe supports & appurtenances that are a part of the plumbing contract documents.
2. Insulating Contractor's current C-2 "Insulation and Acoustical Contractor" license issued by the California State License Board.
3. Testing, Adjusting and Balancing (TAB) Contractor's current AABC license issued by the Associated Air Balance Council or current NEBB license issued by the National Environmental Balancing Bureau and sample TAB report for all plumbing systems.
4. Drawings for installation details that differ from the details in the contract documents.

B. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

C. All details shown on the Drawings are schematic in nature; the Contractor is responsible for determining actual installation requirements. Contractor shall include in his bid all materials and appurtenances for a complete and operable installation. Provide shop drawings for the proposed installation when coordination with other trades is required.

D. In checking Drawings and Submittals data, the reviewer makes effort to detect errors and omissions. Failure of the reviewer to detect errors or omissions during the review of Drawings and Submittals data shall not relieve the vendors and/or Contractor of his/her responsibility to comply with the Contract Documents.

E. Upon completion of work, provide one set of reproducible as-built drawings and two operation and maintenance manuals. The operation and maintenance manuals shall be in a binder and contain manufacturers' data, manufacturers' warranties and maintenance instructions for the equipment, fixtures and appurtenances installed. The Contractor is responsible for all materials, equipment and appurtenances not reviewed and approved by the Engineer.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State, Federal and other applicable laws and regulations.

B. Drawings are diagrammatic. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space.

C. Manufacturer’s Instructions: Follow manufacturer’s written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. UL Compliance: Provide electrical panels and equipment which are UL or ETL listed.

E. Installer Qualifications: Installer shall be trained and certified in the proper installation of plumbing systems by a nationally or regionally recognized training or certification program. Uncertified persons may perform plumbing installation where under the direct supervision and responsibility of a person trained and certified to install plumbing systems. Installers of polypropylene piping systems, ProPress and other specialty systems, shall be trained and certified by the respective manufacturer.

F. Pipe insulation and jacketing must be installed by a Contractor normally engaged in this type of work and holds a current C-2 Insulation Contractor license issued by the California State Licensing Board. Contractor must provide license information with submittals.

1.7 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

A. The named materials and equipment are considered the basis for design; however equal materials and equipment may be submitted to the Architect and Engineer for review. The decision of the Owner and Engineer shall be final and shall govern as to what materials and equipment may be substituted, but the burden of proof as to the quality, performance and space requirements of any proposed substitution shall rest with the Contractor.

1.8 WARRANTY

A. The Contractor shall provide a one-year warranty for the work of this Section. During this period the Contractor shall provide all labor and materials necessary to repair or replace defective systems. The warranty period shall begin at the date of final acceptance, per section 3 below.

B. Additional Warranty conditions: Where applicable, provide additional warranty time period and/or conditions in accordance with the General Conditions Section of the project Specifications manual.

1.9 GENERAL

A. The locations, sizes, capacities and types of all piping, equipment and appurtenances shown on the Drawings as existing are approximate and may not have been independently verified. The Contractor shall determine the exact locations, sizes, capacities and types of existing piping, equipment and appurtenances. If necessary use electronic pipe locating devices to locate existing piping below grade. The Contractor shall include in his bid allowances for minor modifications to pipe routing necessitated by actual field conditions.

B. The Contractor shall verify all building dimensions with Architectural Drawings and all site dimensions with Civil Drawings prior to submitting a bid. The submission of a bid or proposal will be construed as evidence that the Contractor has familiarized himself with the Drawings and building site. Claims made subsequent to the proposal for materials and/or labor due to difficulties encountered will not be recognized unless these difficulties could not have been foreseen, even though proper examination had been made.

C. Provide Turnkey operation of all plumbing systems described in the Drawings and Specifications. Provide all materials and labor required for complete operational systems, unless specifically noted as provided by others on the Drawings and Specifications; or specifically excluded in the bid. Provide all cleaning, test, balance & commissioning of systems to guarantee proper

operation at project completion. Inform the Owner and General Contractor of the timing of all work to be done and the requirements of other trades so the work can be completed in a timely fashion. With the bid, provide a list of all equipment and material that have lead times exceeding 4 weeks. Clearly indicate expected lead times for such equipment and material.

D. In these Drawings and Specifications "Exposed" defines plumbing systems that are visible, such as in equipment rooms, vaulted building spaces, on roofs and where not concealed. "Concealed" refers to plumbing systems that are not normally visible, such as above ceilings and in shafts/walls.

2. PRODUCTS

2.1 PIPE

A. See “PIPE MATERIALS SCHEDULE” on Plumbing drawing sheet

B. Sanitary drain, waste and vent (DWV) pipe and fittings:

1. Above grade: No hub cast iron (NHCI) to ASTM A 888 or CISPI 301. All pipe and fittings shall be of the same manufacturer: Charlotte Pipe and Foundry, AB&I, Tyler or approved equivalent.

a) Above grade, inside structure (Medium Duty): No hub couplings shall meet ASTM C 1540 and FM 1680, Class 1. No hub couplings shall be constructed of Type 304 stainless steel with 305 stainless steel worm drive screws. (Corrugated shield, 4 band 80 inch pound torque or non-corrugated 2 band 80 inch pound torque minimum). The gasket material shall be neoprene rubber meeting the requirements of ASTM C-564. Husky HD2000, or CLAMP-ALL HI-TORQ 125 or approved equivalent.

b) Transition couplings at concrete slab to be HUSKY SD 4200 PVC x CI, ASTM C 1460 type 304 stainless steel with type 305 stainless steel screws torqued to 80 inch pounds.

2. For vent piping in areas of tight construction, hard drawn copper DWV tube may be used as alternate to above.

3. Below grade: Polyvinyl Chloride (PVC) type 1, grade 1, per ASTM D2665 solid core (cellular core will not be accepted), Schedule 40 manufactured by Charlotte Pipe, Harvel Plastics, or Mueller Industries. Underground to be installed per ASTM D2321 to ensure proper bedding and backfilling so deflection is limited to 5%. Working temperature not to exceed 140 F. Flame spread rating of 0-25 when tested per ULC-S102-2-M88. PVC piping shall not be threaded. Solvent cement shall be in accordance with ASTM for use with PVC. Solvent welding shall not be done in ambient temperatures below 40 degrees F or above 110 degrees F, and in accordance with manufactures installation instructions. Changes from PVC to other materials shall be made with fittings designed for that purpose. Where PVC changes to hubless cast iron, provide a PVC adapter fitting (spigot x hub). Test piping only after cemented joints are properly cured. All piping in trenches shall have 6" bed of salt free river sand or salt free, washed pea gravel. Backfill to 6" above pipe with salt free river sand or salt free, washed pea gravel.

C. Below grade Lab Waste (LW) piping and ware washer drain piping: Polyvinyl Chloride (CPVC) type 1, grade 1, per ASTM D2665 solid core (cellular core will not be accepted), Schedule 40 manufactured by Charlotte Pipe, Harvel Plastics, or Mueller Industries. Underground to be installed per ASTM D2321 to ensure proper bedding and backfilling so deflection is limited to 5%. Working temperature not to exceed 140 F. Flame spread rating of 0-25 when tested per ULC-S102-2-M88. PVC piping shall not be threaded. Solvent cement shall be in accordance with ASTM for use with PVC. Solvent welding shall not be done in ambient temperatures below 40 degrees F or above 110 degrees F, and in accordance with manufactures installation instructions. Changes from CPVC to other materials shall be made with fittings designed for that purpose. Where CPVC changes to hubless cast iron, provide a CPVC adapter fitting (spigot x hub). Test piping only after cemented joints are properly cured. All piping in trenches shall have 6" bed of salt free river sand or salt free, washed pea gravel. Backfill to 6" above pipe with salt free river sand or salt free, washed pea gravel.

D. Storm drainage (SD), rainwater and overflow (rainwater) inside building and to five feet from building same as DWV above.

E. Domestic water piping.

1. Pipe: Hard draw Type "L", ASTM B88 with color markings per CBC.

2. Fittings: Wrot solder joint fittings by NIBCO, MUELLER or approved equal. Cast copper alloy, lead free and in accordance with ASME B16.18 and NSF

61G. Soldered with CANFIELD “100% watersafe” lead free solder or Copper tube fittings: ProPress by Viega. Lead free elbows, couplings, reducers, tees, threaded adapters, unions, caps and flanges with copper cold press connection technology. All threaded fittings to be Bronze. 200 PSI operating pressure and 0-250 F operating temperature. Connections shall only be made to hard drawn tubing which has been cut square with a wheel cutter, removed of scale, slag, dire and debris, and burrs removed with a deburring or reaming tool. Press connections shall be made in accordance with manufacturer’s instructions and ensure the fitting is squarely aligned and inserted fully and pressed with approved tool.

3. Trap primers: Cross-linked polyethylene (PEX) tubing, color white.

4. All water pipe and fittings at water heaters and water tanks to be copper, brass or stainless steel. No ferrous pipe or fittings shall be used.

F. Filtered water (FW): GEORG FISCHER PROGEF NATURAL PP schedule 40 polypropylene with BCF PLUS fusion welded fittings.

G. Condensate drainage piping: Type “M" copper pipe and fittings. At condensing appliances provide schedule 40 PVC-DWV plastic, per ASTM D2665-93a.

H. Fuel Gas piping: per NFPA 54:

1. Above grade up to 5” diameter: Schedule 40 black steel (all galvanized at any outdoor locations) pipe with threaded fittings, ASTM A53, Grade B.

2. Below grade, outside of the building: Medium density Polyethylene (PE) fuel gas pipe and fittings, Performance Pipe DRISCOPLEX 6500 series or approved equivalent, per NSF Gas and DOT 49 CFR 192, ASTM D2513 or ASTM D2517 with maximum SDR of 11.5, and installed per manufacturer’s instructions.

3. Outside the building risers and transitions: AGA listed polyethylene pipe and fittings with fused welded joints. AGA listed one piece pre-bent factory fabricated anodeless riser with epoxy bonded steel carrier above grade, ASTM D2513 CAT 1, ASTM F1973, George Fisher commercial model PE2406/PE2708, PE3408/PE4710 or approved equivalent.

2.2 PIPING SPECIALTIES

A. Sound and Vibration Isolators: All water systems and drainage piping systems, including supply, return, waste and drain shall be installed with vibration isolators and shall be isolated from the any structural member, wall sections or other materials that could transmit sound to the occupied areas. All hangers, straps, brackets, and supports shall have acoustical components or combined neoprene and plastic. Provide isolator to isolate complete pipe contact area. All isolation materials shall have a minimum thickness of 1/2". Install all components as per manufacturer's instructions.

1. For pipes 1-inch or less: ACOUSTO-PLUMB by Specialty Products. For pipes larger than 1-inch TRISOLATOR pipe sleeves by STONEMAN COMPANY (or approved equal) in conjunction with standard metal pipe clamps and hangers or felt lined hangers. Riser clamps shall be isolated with 3/8" thick neoprene pad between the riser clamp ear and the slab.
2. In addition, all rainwater leaders and rainwater overflow drain piping in walls and in floor ceiling spaces shall be insulated for sound with Lowry's acoustical pipe wrap tape. Install per manufacturer's recommendations.

B. Pipe hangers: Tolco, Uni-Strut, Super-Strut or B-Line with zinc electroplated finish. Provide with cushioned clamps inserts. Piping supports shall be felt lined J-type hangers. Use beam clamps at hangers from steel beams. All miscellaneous steel, bolts, rods, nuts and washers shall be cadmium electroplated finish. Use materials that are consistent throughout each space.

C. Roof flashings: At TPO roof flashings to be by roofing contractor. At built up roofs provide 4 pound lead, 12" high by 12" base and stainless steel draw band. At shingle roofs, provide 24 gauge galvanized steel metal jack with neoprene top seal by Oatey or equivalent.

D. Thermometers: Provide thermometers where shown on Drawings and diagrams. Provide solar digital MILJOCO model CDX-93585 or CDX-96085 (on larger pipes) installed with brass thermometer well with extension length past insulation and clear protective display cover.

E. Water Pressure Gauges: Provide pressure gauges where shown on Drawings and diagrams. Provide TREICE model 600CB with 3-1/2" dial and 0-160 PSI range. Include for each pressure gauge, a 1/4" brass needle valve by DWYER

NVII-1B, TREICE or equivalent. Provide needle valve as lead-free for potable water systems.

2.3 VALVES & STRAINERS

A. Use full line size ported valves, types and models as follows:

1. Ball Valves: 4 inch and smaller, UL 258 listed, AGA/CGA/UL/FM approved, bronze body with standard ported hard chrome plated brass ball, lever handle, lead free Apollo Valves 70LF-100 or 70LF-200 series for water systems, unless otherwise noted or approved equivalent by Nibco, Jomar or Milwaukee. Provide extended handle shaft where pipes are insulated.

2. Fuel Gas Valves: 1 inch and smaller: Jomar T-205 or equivalent by Apollo Valves, Nibco or Jomar. 1-1/4 inch to 4 inch: Full port, Jomar T-100NE or equivalent by Apollo Valves, Nibco or Jomar. Gas shutoff at main to building: brass body painted gray, full port, full line size ball valve, locking wing cap, ISO-9002 approved, Jomar 175LWN or equivalent by Apollo Valves, Nibco or Jomar.

B. Check Valves: 2 inch and smaller: Bronze and lead free, Milwaukee Valve UP548T or UP1548T or equivalent by Apollo Valves, Nibco or Jomar.

C. Strainers: Bronze, lead free, wye patter, Watts LF777S/LFS777S or equivalent by Apollo Valves, Nibco or Jomar, Provide ball valve with plug at cleanout connection.

2.4 INSULATION

A. Pipe insulation thickness shall be per California Mechanical Code and California Energy Code (Section 120.3) or as indicated below, whichever is greater. Pipe insulation wall thickness indicated below per California Energy Code Table 120.3-A installed at all piping recirculating sections, electric trace tape, and first eight feet of hot and cold outlet piping for nonrecirculating storage systems, and all hot water piping on residential systems.

1. Fluid Range 105-140 F:
    A. Nominal pipe diameter: less than 1 inch, provide 1.0 inches of insulation wall thickness.
    B. Nominal pipe diameter: 1 inch to less than 4 inch, provide 1.5 inches of insulation wall thickness.

B. Above grade, inside building: Cover all piping, fittings, valves and appurtenances with Owens Corning SSL II with ASJ Max 3.5-5.5 lbs/sqft density, preformed, fiberglass with

all service vapor jacket. Butt ends shall be tightly pressed together. Butt joints shall be covered with ASJ tape. Cover all fittings with Proto or Speedline 20 mil thick PVC fitting covers, color white, verify color with Architect and Owner; and coordinate color with other trades, attached with adhesive recommended by the manufacturer. Insulation in buildings shall have a flame spread rating not to exceed 25 and a smoke density not to exceed 450 when tested in accordance with UBC Standard 8-1, CBC Section 720.2. Exposed pipe and fittings or where routing in return air plenum spaces shall be covered with 25/50 rated Proto or Speedline 20 mil thick PVC jacketing and fitting covers, color white, attached with adhesive recommended by the manufacturer. PVC covers shall be installed watertight; all jackets, penetrations and ends, seams and joints shall be sealed watertight with approved adhesive. Cover all pumps with 1” thick neoprene cover with glued joints. Verify jacketing color with Architect and Owner.

C. Above grade, outside building: Cover all piping, fittings, valves and appurtenances with Owens Corning SSL II with ASJ Max 3.5-5.5 lbs/sqft density, preformed, fiberglass with all service vapor jacket. Butt ends shall be tightly pressed together. Butt joints shall be covered with ASJ tape. Cover all piping and fittings with Proto or Speedline 30 mil thick PVC fitting covers, color white, attached with adhesive recommended by the manufacturer. PVC covers shall be installed watertight; all jackets penetrations and ends, seams and joints shall be sealed watertight with approved adhesive. Cover all pumps with 1” thick neoprene cover with glued joints.

D. Insulation blocks at pipe supports shall be pipe shields calcium silicate blocks, size to match pipe insulation. The insulation jacket shall be butted to the support and sealed watertight to the metal shield. Provide 360 degree 12"long (8" long for piping less than 3" diameter) 18 ga galvanized sheet metal shields at each hanger. Provide 360 degree saddles. Top saddle should overlap bottom saddle. 180 degree saddles at clevis and J-hangers are acceptable.

E. Rainwater Leader (Roof drainage) piping insulation: Insulate the first (20) twenty feet from the roof drain, all horizontal piping, and the underside of the roof drain body. Provide ARMACELL AP ArmaFlex, minimum 1/2” wall thickness. All elbows to be cut miters, and all joints and seams to be tightly glued.

F. Lavatory and sink traps: Manufactured insulators with smooth, white, PVC outer covering, complying with ADA and state accessibility requirements, Truebro Lav Guard 2 or Plumberex Pro-Extreme series. Also insulate the hot water supply valve and pipe. There shall be no sharp or abrasive surfaces under sinks or lavatories.

2.5 ADHESIVES, SEALANTS, CAULKS, PAINTS AND COATING

A. All products shall comply with the VOC limits requirements in California Green Building Code (CALGreen). If a non-conforming product is found in these bid documents, notify the Engineer immediately for an alternate product.

2.6 ACCESS PLATES AND DOORS

A. ACCESS DOORS

1. Tile or wood surfaces: ELMDOR #DW-SS, 16 gauge, type 304 brushed stainless steel construction, or approved equal with optional keyed lock. Minimum size 10”x10”.

2. Gypsum board ceiling: ACCESS PANEL SOLUTIONS, BAUCO PLUS II, architectural access door with concealed hardware, equal STS rating to assembly being installed, concealed touch latch with optional keyed lock. Minimum size 10”x10”.

3. Gypsum board wall: ELMDOR #DWB 16 gage galvannealed steel construction with prime finish or approved equal with optional keyed lock. Minimum size 10”x10”.

4. Fire rated ceiling or walls, ELMDOR FRC or FR series or approved equal with optional keyed lock.

2.7 FIXTURES AND EQUIPMENT

A. Provide fixtures and equipment of the manufacturer and model numbers shown on the Drawings, complete with all required carriers, stops, supplies, trim, and other items necessary for proper operation.

B. Fixture tailpieces and traps for lavatories and sinks shall be KEENEY 17-gauge brass tubing or semi-cast brass with heavy duty chrome plated finish.

C. Sink, lavatory, and tank toilet supply stop valves and supply kits: BRASSCRAFT KTS 1/4 turn ball valves, chrome plated brass finish, lock shield with loose key, stainless steel or chrome plated copper supply tubing.

D. All equipment, fixtures and fittings shall conform to California Energy Commission Certification per CEC subchapter 2, for energy usage and water usage compliance. See equipment schedules for specific ratings.

2.8 FLUES

A. At condensing appliances: PVC type 1, grade 2 1220 lps, schedule 40.

2.9 SIGNAGE, PIPE MARKERS AND EQUIPMENT NAMEPLATES

A. QUALITY ASSURANCE: Meet ANSI A13.1 2007 Scheme for identification of piping systems.

B. MAIN SHUTOFF VALVE SIGNAGE: Provide custom Seton signage for all cold water mains, domestic water mains, non-potable water mains and fuel gas mains. Located as directed by the Owner. Verify final appearance, text size, colors and material with Owner.

C. PIPING MARKERS: Provide Seton Opti-Code or approved equal by MSI, self-adhesive pipe markers for all piping. Pipe markers shall include direction of fluid flow arrows, color coded field and lettering height in accordance with OSHA and ASME (ANSI) Standard A13.1-2007. As a minimum, pipes shall be marked with service and direction at both sides of wall penetration, and every 20 feet but not less than once per room, and shall be visible from the floor level.

D. EQUIPMENT NAMEPLATES: Provide Seton custom engraved acrylic (plastic), Black with white border and lettering, 3” wide by 1” high with minimum 1/4” lettering, attached with two small screws. Provide a label at each piece of major equipment for equipment identification.

2.10 OTHER MATERIALS

A. Other materials not specified, but required for a complete installation, shall be as selected by the Contractor subject to acceptance by the Engineer.

3. EXECUTION

3.1 GENERAL

A. Verify that the work of this Section may be completed in accordance with all pertinent codes and regulations, the Construction Documents, approved Submittals, and the manufacturers' recommendations. In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all discrepancies have been resolved.

B. Install all equipment per manufacturer's instructions and recommendations.

C. Install all equipment level. Install all equipment in accordance with manufactures installation instructions, where plans or detail differ from manufactures' instructions, contact Engineer for clarification before proceeding with installation.

D. Size and location of all housekeeping pads shall be coordinated between subcontractor and general contractor prior to construction. Housekeeping pads are not in plumbing contractor's scope of work.

E. See Structural Drawings for details of underground piping beneath and through building footings.

F. Do not cut into or reduce the size of any load-carrying member without the prior approval of the Architect.

G. Anchor piping subject to expansion or contraction in a manner permitting strains to be evenly distributed. Provide offsets and expansion compensation devices as required to prevent undue stress on the piping and building components. Allow for pipe expansion of 1 inch per 100 feet.

H. Piping shall be securely held in place by hangers, supports & trapezes in accordance with CA Plumbing Code Section 313.0. All hangers shall be designed to support the pipe, including fluid and insulation. Provide hangers and supports at intervals per CPC table 313.3

I. Pipe Supports: All materials shall be new and manufactured for the specific purpose of supporting systems, equipment, pipes and accessories.

J. Where piping passes through foundations, footings or bearing walls, provide PVC pipe sleeves two sizes larger than the pipe passing through the structure. Caulk the annular space between the pipes or provide Link-Seals at foundation walls. Provide chrome plated brass split escutcheons where pipes pass through finished floors, ceilings, or walls.

K. Foam pipe wrap all unsleeved piping passing through or in concrete: Benjamin Mfg. Co. in-sul wrap #6200. Apply in spiral wrap with one third overlap. Provide minimum of 3/8”annular space (between concrete and pipe).

L. Make allowances for building and support structure movement.

M. Provide 1/2" minimum separation between piping and building construction.

N. Place a hanger within 12 inches of each horizontal elbow.

O. Piping shall not be in contact with hangers or building members.

P. Do not support piping from other pipes, ductwork or other equipment that is not building structure.

Q. All steel piping and appurtenances exposed to weather shall be galvanized or zinc plated.

R. Isolate all dissimilar metals with dielectric unions and dielectric flanges, except that brass or bronze valves do not need to be isolated from steel pipe.

S. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non-adhesive isolation tape – B-Line Iso-pipe.

T. Paint any PVC piping and fittings where exposed to direct sunlight with light colored, water based latex paint which compatible with PVC.

U. Where threaded piping connects between plastic and metal materials, provide metal female connection. Do not provide a metal male connection at these types of transitions.

V. All wetted materials for valves and appurtenances shall be the same material of the piping, unless noted otherwise.

W. All valves and appurtenances shall be full line size.

X. Provide accessible shutoff valves at all fixtures, equipment, and appliances. Provide access doors where valves are installed behind or above non-removable construction. Install all below-grade valves in concrete valve boxes. Install boxes flush with the finished grade. Install water hammer arrestors, valves, air vents and other appurtenances in accessible locations, or provide access doors.

Y. Provide straight pipe with a minimum length of six times the pipe diameter upstream of pumps.

Z. Provide UL listed fire stopping, installed per manufacturer's recommendations, where pipes pass through fire rated construction.

AA. All horizontal waste piping and horizontal rainwater piping is to be at a 2% slope unless otherwise noted on the Drawings.

BB. Seal all vapor barriers and insulation jacketing watertight, per manufacturer's instructions. Use approved materials to seal ends of insulation watertight.

CC. Ends of insulation shall be tightly butted together and held in place with bands at a max of 24" on centers

DD. Insulate all piping components, including but not limited to flexible connectors/expansion joints, valves, pumps, fittings and appurtenances.

EE. Test plugs must be installed to clear insulation.

FF. Valve handles shall be installed to clear insulation/jacket by 3/4" (minimum).

GG. Finish insulation neatly at pipe supports.

HH. Provide pre-molded fitting covers for all pumps, fittings, valves and appurtenances. Fitting covers must be easily removable for access to equipment and valves.

II. All insulation jacketing laps and band seals to be placed in such a way as to be hidden when viewed from the most traveled locations. Insulation located outdoors where exposed to weather, must be installed with the jacket seams on bottom of piping. All banding and support shields are to be installed with equal spacing and in a uniform manner. Applications of caulking at any joints are to be kept at an absolute minimum.

JJ. Insulate and jacket cold water piping, outside the building, where exposed to exterior ambient conditions, for freeze protection.

KK. At accessible flush valve type water closets, to avoid conflict with the grab bars, adjust cold water rough-in elevation to verify that the top of the flush valve clears the bottom of the grab bar while maintaining the 6” minimum critical level mark on the vacuum breaker, verify with manufacturer.

LL. All piping in trenches shall have bedding from 6 inches below pipe to 4 inches above pipe. Bedding material to be 1/4 inch min. fill sand by Canyon Rock Company or approved equivalent. Bedding must be clean and compacted so as to protect and uniformly support the pipe enclosure. Provide backfill above bedding. Backfill material specification is provided by Others. Prior to construction - verify backfill material specification with General Contractor. Bedding and backfill materials must not contain boulders, cinder fill, construction debris or materials that will damage or break the piping or cause corrosive action. Provide bedding material submittal for review and approval.

3.2 ENERGY CODE TESTING, ADJUSTING AND REPORTING

A. The Contractor shall test and commission all plumbing equipment shown on the Plumbing Drawings**.** Testing and documentation shall be in accordance with manufacture’s installation instructions and California Energy Code NRCC-PLB certificate of compliance forms.

B. The Contractor shall coordinate and schedule with the General Contractor, (or owner where applicable), controls contractor, other subcontractors and the owner as necessary to complete all testing in a timely manner.

C. The Contractor shall submit all completed and signed commissioning documents in one package (in PDF format) to the Mechanical Engineer of Record for review and approval. Any comments and/or corrections shall be addressed promptly, retested, and an updated report resubmitted for approval prior to completion. Provide an additional copy to the building department official where requested.

3.3 COMMISSIONING OF PLUMBING

A. The Commissioning Agent (CxA) for this project will be appointed by the Architect or Owner. The CxA will provide the Owner's Project Requirements (OPR), Basis of Design (BOD), the commissioning plan and will prepare the final commissioning report.

B. The Contractor shall perform all the required functional performance testing and checklists, Plumbing testing, adjusting and balancing (TAB), and Operation and maintenance (O & M) manuals, systems manuals, systems operations training and inspection reports as required by California Energy Code including NRCC-PLB certificate of compliance forms.

C. The Contractor shall coordinate and schedule with the General Contractor, (or owner where applicable), controls contractor, other subcontractors and the owner as necessary to complete all testing in a timely manner.

D. The Contractor shall provide written Functional performance testing and TAB reports to the Commissioning Agent (CxA) for approval. The reports shall be dated and signed by the individual responsible for performing these services. Any comments and/or corrections shall be addressed promptly, retested, and an updated report resubmitted for approval prior to completion.

3.4 REQUIREMENTS FOR ACCEPTANCE

A. Make arrangements with the Engineer and the Building Inspector to observe the Work prior to covering or enclosing the work.

B. Clean and flush all piping systems and equipment to remove all contaminants.

C. Sterilize all domestic hot and cold water piping with chlorine solution for a minimum of 24 hours. The residual chlorine concentration shall not be less than 50 PPM. Thoroughly flush the piping systems after the sterilization is completed. Coordinate times of sterilization with the Owner. Provide warning signs during sterilization to prevent system use during sterilization. Provide documentation that indicates when the sterilization was completed.

D. Testing, Adjusting and Reporting: Operate all equipment that is a part of this Division and report the following:

1. Pumps: motor amps, pump rotation direction, differential pressure.
2. Water heaters: Hot water supply temperature.

E. Test, adjust and balance all pumps and pumping systems and hydronic piping systems in accordance with AABC National Standards for Field Measurements and Instrumentation. Testing shall be done by an AABC licensed TAB Contractor or independent certified NEBB Contractor which in not affiliated with a Mechanical Contractor, design Engineer or equipment manufacturer. Provide test reports for approval. The test reports shall include, but not be limited to the following information:

1. Operating and nameplate data for all pumps and pumping equipment; including motor speed and motor amps.

F. Adjust and test all tempering valves to the scheduled temperature (where not scheduled provide 105 F at public lavatories and hand sinks, and all others provide at 120 F).

G. Test the plumbing systems as outlined below. Isolate all equipment, instruments, and gauges that are not rated for test pressure. If the piping fails the test, repair faulty sections and retest. Provide documentation that all piping systems passed pressure test, indicate day of test and ambient temperature. Piping must be pressure tested and inspected prior to being insulated.

1. DWV systems: Test with a 10 foot water head for a minimum of one hour.
2. Water lines: Test with water at 100 PSIG for 24 hours.
3. Fuel gas: Test with air at 15 PSIG for 8 hours, or as required by CPC.

H. An “as-built” red lined drawing set shall be kept on site and updated daily. These “as-builts” shall include the full scope of the design documents and specifications in this section of work. For underground systems include piping depth/invert elevations and exact dimension to grid lines for underground mains. Submit “As-builts” to General Contractor and Owner.

I. Prior to job completion, submit redlined as-built drawings in PDF format (color, 200 to 300 DPI resolution) to the Engineer and Owner.

J. Provide operation and maintenance manuals on all equipment include equipment warranties certificates.

K. Instruct the Owner on how to operate and maintain all systems and equipment that are a part of this Section.

END OF SECTION

DIVISION 23 00 00

MECHANICAL

1. GENERAL

1.1 SCOPE

A. The work in this section includes, but is not limited to, providing all mechanical work as shown and noted on the mechanical Drawings and Specifications, including the following items:
1. Mechanical equipment and appurtenances.
2. Ductwork, duct insulation and appurtenances.
3. Vibration Isolation.
4. Controls & control wiring.
5. Refrigerant piping and insulation.
6. Pipe hangers and supports.
7. Piping markers and equipment nameplates.
8. Energy code testing, adjusting and reporting.
9. Commissioning of Mechanical systems.

B. Work of other sections includes the following:
1. Line voltage wiring and disconnect switches. The Electrical Contractor will provide all line voltage wiring & conduit, disconnect switches & magnetic starters (except those furnished under this Section as a part of packaged mechanical equipment).
2. Condensate drainage piping from mechanical equipment.

1.2 CODES AND STANDARDS

A. All work and materials shall be in full accordance with the latest adopted edition of the following documents:
1. 2022 California Building Code (CBC)
2. 2022 California Plumbing Code (CPC)
3. 2022 California Mechanical Code (CMC)
4. 2022 California Electrical Code (CEC)
5. 2022 California Fire Code (CFC)
6. 2022 California Energy Code (Title 24)
7. 2022 California Green Building Code (CALGreen)
8. National Electric Code (NEC)
9. Americans with Disabilities Act (ADA)
10. Sheet metal Contractors and Air Conditioning Contractors' National Association (SMACNA), HVAC Duct Construction Standards.
11. National Fire Protection Association (NFPA)
12. Local codes and ordinances

B. Whenever this specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity takes precedence.

1.3 DRAWINGS AND SPECIFICATIONS

A. Where a conflict exists between Drawings and Specifications, promptly notify the Architect for interpretation and resolution. The most stringent requirements shall be used for bid.

1.4 PERMITS

A. The Contractor shall obtain all permits, licenses and fees that are required to perform the work. Provide the Architect with the original certificates, permits, licenses and receipts for fees.

1.5 SUBMITTALS

A. Provide complete product submittals and shop drawings in electronic format (PDF), as one complete package, prior to commencing work or prior to ordering any materials. **Piecemealed product submittals may be rejected.** Clearly identify/mark each submittal in detail. Note what differences, if any, exist between the submitted Item and the specified Item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings. Items, other than those specified, will not be allowed unless they are approved in writing via the submittal process. Include cut sheets and drawings for the following items in the submittal:

1. All mechanical components that are a part of the mechanical contract documents.
2. Insulating Contractor’s current California C-2 Insulation license issued by the California State Licensing Board and insulation materials.
3. Testing, Adjusting and Balancing (TAB) Contractor’s current AABC license issued by the Associated Air Balance Council with sample TAB report of a similar air moving system.
4. Drawings for installation details that differ from the details in the contract documents.
5. Control drawings for all control work that is specified in the mechanical contract documents.
6. Provide shop drawing for all VRF system refrigerant piping routing through the building.

B. The TAB report must include the capture velocity testing. The capture velocity testing shall be performed in a 1 square foot grid pattern at the face of each hood. Air velocity measurements shall be taken using a calibrated air velocity measurement instrument at the center of each grid, then averaged to obtain average capture velocity. Document the distance from the exhaust inlet/registers, or baffles, hood type (Slot, Booth, Canopy, Flanged and/or unflanged hood etc.). Document the size and location of equipment present upstream of the grid, if

applicable, to explain capture velocity differences. The TAB report must also include visualization testing. Observing generated smoke/vapor makes it possible to determine direction of air flow, turbulence and location of dead spots. Smoke/vapor shall be generated between the proposed location of the worker and the exhaust register (e.g., smoke should not be generated upstream of worker to avoid unnecessary worker exposure to testing agent). This should be consistent with the expected or known area of contaminant generation. This may be achieved by using smoke tubes or dry ice in a bucket with warm water.

C. “No Exception Taken” constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. All details shown on the Drawings are schematic in nature; the Contractor is responsible for determining actual installation requirements. Contractor shall include in his bid all materials and appurtenances for a complete and operable installation. Provide shop drawings for the proposed installation when coordination with other trades is required. The Contractor is responsible for all materials, equipment and appurtenances not reviewed and approved by the Engineer. Contractor shall coordinate with framing contractor all framed out opening locations and sizes in floors, walls, and roofs prior to construction.

E. In checking Drawings and Submittals data, the reviewer makes effort to detect errors and omissions. Failure of the reviewer to detect errors or omissions during the review of Drawings and Submittals data shall not relieve the vendors and/or Contractor of his/her responsibility to comply with the Contract Documents.

F. Upon completion of work, provide one set of reproducible as-built drawings and two operation and maintenance manuals. The operation and maintenance manuals shall be in a binder and contain manufacturers' data, manufacturers' warranties and maintenance instructions for the equipment, fixtures and appurtenances installed. The Contractor is responsible for all materials, equipment and appurtenances not reviewed and approved by the Engineer.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State, Federal and other applicable laws and regulations.

B. Drawings are diagrammatic. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. UL Compliance: Provide electrical panels and equipment which are UL or ETL listed.

E. Installer Qualifications: Installer shall be trained and certified in the proper installation of mechanical systems by a nationally or regionally recognized training or certification program. Uncertified persons may perform mechanical installation where under the direct supervision and responsibility of a person trained and certified to install mechanical systems.

F. Pipe insulation and jacketing must be installed by a Contractor normally engaged in this type of work and holds a current C-2 Insulation Contactor license issued by the California State Licensing Board. Contractor must provide license information with submittals.

G. Controls Contractor Qualifications: Installers for the control system shall be a contractor whose sole business is temperature control systems.

1.7 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

A. The named materials and equipment are considered the basis for design; however equal materials and equipment may be submitted to the Architect and Engineer for review. The decision of the Owner and Engineer shall be final and shall govern as to what materials and equipment may be substituted, but the burden of proof as to the quality, performance and space requirements of any proposed substitution shall rest with the Contractor.

1.8 WARRANTY

A. The Contractor shall provide a one-year warranty for the work of this Section. During this period the Contractor shall provide all labor and materials necessary to repair or replace defective systems. The warranty period shall begin at the date of final acceptance, per Section 3 below.

B. Additional warranty conditions: Where applicable, provide additional warranty time period and/or conditions in accordance with the General Conditions Section of the project Specifications manual.

1.9 GENERAL

A. The locations, sizes, capacities and types of all piping, equipment and appurtenances shown on the Drawings as existing are approximate and may not have been independently verified. The Contractor shall determine the exact locations, sizes, capacities and types of existing piping, equipment and appurtenances. If necessary, use electronic pipe locating devices to locate

existing piping below grade. The Contractor shall include in his bid allowances for minor modifications to pipe routing necessitated by actual field conditions.

B. The Contractor shall verify all building dimensions with Architectural Drawings and all site dimensions with Civil Drawings prior to submitting a bid.

C. The submission of a bid or proposal will be construed as evidence that the Contractor has familiarized himself with the Drawings and building site. Claims made subsequent to the proposal for materials and/or labor due to difficulties encountered will not be recognized unless these difficulties could not have been foreseen, even though proper examination had been made.

D. Provide Turnkey operation of all mechanical systems described in the Drawings and Specifications. Provide all materials and labor required for complete operational systems, unless specifically noted as provided by others on the Drawings and Specifications; or specifically excluded in the bid. Provide all cleaning, test, balance & commissioning of systems to guarantee proper operation at project completion. Inform the Owner and General Contractor of the timing of all work to be done and the requirements of other trades so the work can be completed in a timely fashion. With the bid, provide a list of all equipment and material that have lead times exceeding 4 weeks. Clearly indicate expected lead times for such equipment and material.

2. PRODUCTS

2.1 DUCTWORK

A. Ductwork shall be constructed from galvanized sheet metal in accordance with the latest edition of “SMACNA HVAC Duct Construction Standards”.

1. Outdoor ductwork to be built to 4” WC pressure class and seal class A.
2. Indoor ductwork to be built to 4” WC pressure class and seal class B.

B. Outdoor Rectangular Ducts: Longitudinal seams to be Pittsburgh seams with sealant inside joint. Transverse seams to be MEZ TDC with compatible metal cleats and corners or manufactured TDF system meeting SMACNA class J by Ductmate or approved equal. Additionally install over exterior seams a 1/4” bead of Vulkum 642 or Silkaflex sealant. Diagonally cross break all ducts.

C. Concealed Round Ducts and Fittings: Spiral duct with RL-1 spiral lock seams by United McGill Uni-Seal, Mina Metals or approved equal. Wye branches, Laterals and Tap-ins to be conical, tapered body or low loss type. Elbows to be 1.5-radius segmented, stamped or gored. Join ducts with RT-1 beaded sleeve joints attached per SMACNA Standards.

D. Flexible Ducting at final supply and return connections: Class 0 or Class 1, pre-insulated with minimum R-6, to be used in concealed, conditioned, areas on the supply and return only. 5'-0" maximum length at final connection to outlet. ATCO

series #036 (R-6). All connections shall be wrapped with three layers of UL rated duct tape and secured with stainless steel gear clamps or 0.345" (9 mm) heavy duty nylon cable ties, Catamount series 175 or equal by Panduit, or Thomas & Betts, tightened with factory tool.

2.2 DUCT INSULATION AND LINER

A. Duct wrap
1. Supply, return and make-up air ducts in conditioned concealed spaces: Owens Corning SoftR, fiberglass with FRK Foil-facing, 1-1/2" thick, type 75, R-5.1, or approved equal by Certainteed or Knauf.
2. Supply, return, outside and make-up air ducts in unconditioned concealed spaces communicating with outdoors: Owens Corning SoftR, fiberglass with FRK Foil-facing, 3" thick, type 75, R-10, or approved equal by Certainteed or Knauf.

B. Duct liner
1. Exterior ducts and unconditioned spaces: Owens Corning QuietR type R-8, 2" thick or approved equal by Certainteed or Knauf.
2. Supply, return and make-up air ducts in conditioned concealed spaces Owens Corning QuietR type R-4.2, 1" thick or approved equal by Certainteed or Knauf.
3. Supply, return and make-up air ducts in unconditioned concealed spaces communicating with outdoors: Owens Corning QuietR type R-8.0, 2" thick or approved equal by Certainteed or Knauf.
4. At all register cans: Owens Corning type 75, minimum 1/2" thick, or approved equal by Certainteed or Knauf.

C. All insulation shall have a flame spread rating of not more than 25 and a smoke-developed rating of not more than 50.

2.3 DUCT SPECIALTIES

A. Duct joint sealer: Hardcast duct seal 321 or equal United McGill, indoor and outdoor duct sealer, gray smooth finish, water based low VOCs. Up to 10" WG duct pressure rated. Install 20 mil thickness minimum. Where duct sealer is installed outdoors and installed during wet conditions, use Hardcast metal bond.

B. Duct access doors: Elmdor DT series, minimum 24 gauge, double wall construction with insulated and gasketed between panels.

C. Duct flex connectors: 24 gage galvanized iron with grip lock seams meeting NFPA 701, 90A & 90B. Indoors, Duro Dyne Excelon #10210 MBX, color black or approved equal. Outdoors, Duro Dyne Durolon #10159 (or #10210 at TDC connectors), color white or approved equal.

D. Turning vanes: Aero-Dyne “Double wall” or Ductmate Industries Prorail, double radius, minimum 26 gauge vanes with 24 gauge siderails. Do not install in ducts with smaller dimension less than 11”.

E. Duct tape: Polyken 558CA air duct closure system, 14 mils thick. CEC approved.

2.4 ECONOMIZERS

A. Where economizers are scheduled on the mechanical equipment schedule, they shall meet the requirements of CEC section 104.4(e).4 which includes:
1. 5 Year warranty.
2. Damper reliability testing to 60,000 cycles.
3. Damper leakage maximum rate of 10 CFM/SF at 1”WC.
4. Adjustable high limit setpoint.
5. Calibrated sensor accuracy per CEC.

2.5 VOLUME DAMPERS

A. Galvanized steel minimum 24 gage sleeve, 16 gage blade with Ventlok 638 regulator locking quadrant.
1. At ducts up to 14” round: Greenheck VCDR-50 single blade with locking quadrant.
2. At ducts 16” and larger round: Greenheck VCDRM-50 multi blade with locking quadrant.

2.6 AIR FILTERS

A. Flanders or approved equal by Farr or Camfil. Air filters shall be pleated disposal type with MERV rating per equipment schedule (or minimum MERV 13 rating for any system with at least 10 feet of ducting attached). Provide minimum 2 inch where possible.

2.7 REFRIGERANT PIPING (VRF SYSTEMS)

A. Refrigerant piping from outdoor units to indoor Branch Controller units. Liquid and suction refrigerant piping shall be type “ACR” copper tubing, hard drawn straight-length by Mueller Industries or approved equal, with forged copper fittings and long radius ells (at suction). Copper to copper joints shall be brazed with copper-phosphorous brazing alloy containing minimum of 15% silver (Sil-Fos 15 or approved equal). And during all brazing an inert gas (such as dry nitrogen or argon) shall be continuously passed through the system at a flow rate sufficient to maintain an oxygen free environment to prevent the formation of copper oxide scale inside the piping.

B. Refrigerant piping from heat recovery (branch) units to indoor units: Liquid and suction refrigerant piping shall be type “ACR” copper (soften) tubing by Mueller Industries or approved equal. Copper to copper joints shall be brazed with

copper-phosphorous brazing alloy containing minimum of 15% silver (Sil-Fos 15 or approved equal). And during all brazing an inert gas (such as dry nitrogen or argon) shall be continuously passed through the system at a flow rate sufficient to maintain an oxygen free environment to prevent the formation of copper oxide scale inside the piping. Maximum length of 100 feet. Piping from heat recovery (branch) units to Fan coils to be continuous without couplings or joints.

2.8 REFRIGERANT PIPING (NON VRF)

A. Refrigerant piping systems under 5 tons nominal capacity and were concealed inside the building: Soft annealed copper tubing “line sets” are allowed when approved by the Engineer and are to be installed in conformance with CMC Section 1109.7. Provide protection from damage (mechanical injury) as required. Soft copper shall not exceed 1-1/8 inch nominal size and mechanical connections shall not be made on tubing exceed 3/4 inch nominal size.

2.9 REFRIGERANT PIPE INSULATION

A. Refrigerant pipe supports and clamps: Superstrut series 1400 “GOLDGALV” metal framing channel or approved equivalent by B-LINE. At insulated pipe provide Armafix insert per Specification below. Clamps at uninsulated pipes: Superstrut A-716 or A-717 cushioned clamps.

B. Hanger support: Superstrut C-711F or C-727 J hanger. At insulated pipe provide Armafix insert per Specification below.

C. Insulated pipe supports: Armacell Armafix IPH / NPH insulated pipe hanger with longitudinal seams with self-adhering closure strips, 0.27 BTU-in/hr -SF-F thermal conductivity, and 30 mil thick painted aluminum or unpainted stainless steel shell. Seams shall be glued tightly to form a continuous vapor barrier.

D. Armacell Armaflex AC elastomeric insulation, thickness per Title 24. – California Energy Code. Covering to be continuous with all seams and joints glued tightly. All fitting shall be cleanly mitered with proper cutting tool. Cover all exposed indoor and outdoor piping with continuous white PVC jackets, Proto “Lo Smoke” or equal, including all fittings and valves. Insulation shall have a flame spread rating not to exceed 25, a smoke density rating not to exceed 450, and a smoke-developed rating not to exceed 50.

2.10 CONTROLS

A. Provide complete automatic controls for all heating, ventilating and air conditioning systems, including room thermostats, control valves and all necessary control wiring, transformers, and panels. Refer to the "Control Description" on the Drawings for control sequences and specifications.

B. Install all low voltage wiring, which is not concealed in any walls or attics, shall be installed in conduit (EMT). All outdoor control wiring shall be installed in either rigid or sealtight conduit.

C. Install all Thermostats, switches and controls at elevations shown on Architectural Drawings. Where not shown on Architectural Drawings, install devices such that all controls are within 48" of the finished floor. Where possible match centerline of lighting controls in the same room.

2.11 PIPING SPECIALTIES

A. Pipe hangers: Tolco, Uni-Strut, Super-Strut or B-Line with zinc electroplated finish. Provide with cushioned clamps inserts. Piping supports shall be felt lined J-type hangers. Use beam clamps at hangers from steel beams. All miscellaneous steel, bolts, rods, nuts and washers shall be cadmium electroplated finish. Use materials that are consistent throughout each space.

2.12 ADHESIVES, SEALANTS, CAULKS, PAINTS AND COATING

A. All products shall comply with the VOC limits requirements in CALGreen Code section 5.504. If a non-conforming product is found in these bid documents, notify the Architect immediately for an alternate product.

2.13 ACCESS PLATES AND DOORS (CEILING AND WALLS)

A. Tile or wood surfaces: ELMDOR #DW-SS, 16 gauge, type 304 brushed stainless steel construction, or approved equal with optional keyed lock. Minimum size 10”x10”.

B. Gypsum board ceiling: ACCESS PANEL SOLUTIONS, BAUCO PLUS II, architectural access door with concealed hardware, equal STS rating to assembly being installed, concealed touch latch with optional keyed lock. Minimum size 10”x10”.

C. Gypsum board wall: ELMDOR #DWB 16 gage galvannealed steel construction with prime finish or approved equal with optional keyed lock. Minimum size 10”x10”.

D. Fire rated ceiling or walls, ELMDOR FRC or FR series or approved equal with optional keyed lock.

2.14 EQUIPMENT

A. Provide equipment of the manufacturer and model numbers shown on the Drawings, complete with all required trim and other items necessary for proper operation.

B. All equipment, fixtures and fittings shall conform to California Energy Commission Certification per CEC subchapter 2, for energy usage and water usage compliance. See equipment schedules for specific ratings.

2.15 PIPE MARKERS AND EQUIPMENT NAMEPLATES

A. QUALITY ASSURANCE: Meet ANSI A13.1 2007 Scheme for identification of piping systems.

B. Piping markers: Provide Seton Opti-Code or approved equal by MSI, self-adhesive pipe markers for all piping. Pipe markers shall include direction of fluid flow arrows, color coded field and lettering height in accordance with OSHA and ASME (ANSI) Standard A13.1-2007. As a minimum, pipes shall be marked with service and direction at both sides of wall penetration, and every 20 feet but not less than once per room and shall be visible from the floor level.

C. Equipment nameplates: Provide Seton custom engraved acrylic (plastic), Black with white border and lettering, 3” wide by 1” high with minimum 1/4” lettering, attached with two small screws. Provide a label at each piece of major equipment for equipment identification.

2.16 OTHER MATERIALS

A. Other materials not specified, but required for a complete installation, shall be as selected by the Contractor subject to acceptance by the Engineer.

3. EXECUTION

3.1 GENERAL

A. Verify that the work of this Section may be completed in accordance with all pertinent codes and regulations, the Construction Documents, approved Submittals, and the manufacturers’ recommendations. In the event of discrepancy, immediately notify the Engineer. Do not proceed in areas of discrepancy until all discrepancies have been resolved.

B. Install all equipment, valves, controls and appurtenances in accordance with manufacturers' instructions. Install all ductwork Per CMC requirements and SMACNA standards.

C. Size and location of all housekeeping pads shall be coordinated between subcontractor and general contractor prior to construction. Housekeeping pads are not in mechanical contractor’s scope of work.

D. Provide access to all components requiring adjustment. Provide access panels where these components are concealed behind non-accessible construction. Label access panels with description of service.

E. Install ductwork upstream and downstream of fans with as few offsets and elbows as possible. If conditions allow, provide a minimum of 3 fan diameters of straight duct upstream of fan intakes. Do not provide less straight duct upstream and downstream of fans than indicated on the Drawings without authorization from the Engineer.

F. Cover all duct openings and protect mechanical equipment during construction at time of rough installation and during storage on construction site until final startup all duct and other related air distribution components 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. And in accordance with the CALGreen section 5.504.3.

G. Provide approved flexible connections between fans and ducts.

H. Duct sizes shown on the Drawings are clear airflow dimensions, inside the insulation.

I. Provide double-thickness turning vanes at all duct elbows 10” or wider unless noted otherwise on Drawings.

J. Seal all duct seams and joints with approved joint sealant. Seal ducts exposed to weather watertight. Slope top of exterior ducts to shed rain.

K. Install ducts in the locations shown on the Drawings. If interference with pipes, structure etc. requires a change in duct shape or size, obtain approval from the Engineer before installing duct.

L. Install flexible ducts in a fully extended condition free of kinks and maximum sag of 1/2" per foot. Support on 48" centers with 1-1/2" wide galvanized iron strap minimum 24 gauge. All elbows shall be made with a minimum radius of 1.5 times the duct diameter.

M. Where access doors are required in ductwork, for access to internal components, provide doors with an airtight seal. Label access panels with description of service.

N. Where branch ducts tap in main ducts, provide 45 degree entry tap with clinch lock connection or conical fitting one duct size larger than branch.

O. Provide a continuous vapor barrier on all chilled water and refrigerant suction pipe insulation. All closed cell insulation shall be glued at all seams and joints.

P. Do not cut into or reduce the size of any load-carrying member without the prior approval of the Architect.

Q. All registers with sheet metal cans shall be internally lined with duct liner.

R. Suspend ducts with sheet metal straps and hangers from structural building components.

S. Piping shall be securely held in place by hangers, supports & trapezes in accordance with CA Mechanical Code Section 313.0. All hangers shall be designed to support the pipe, including fluid and insulation. Provide hangers and supports at intervals per CPC table 313.3

T. Provide weather-proof flashing for all piping extending through roofs and walls.

U. Anchor piping subject to expansion or contraction in a manner permitting strains to be evenly distributed. Provide offsets and expansion compensation devices as required to prevent undue stress on the piping and building components. Allow for pipe expansion of 1 inch per 100 feet.

V. Paint any PVC piping and fittings where exposed to direct sunlight with light colored, water based latex paint which compatible with PVC.

W. Where PVC jackets are installed, PVC jackets shall be continuous, covering all fittings, with water-tight seams. Protect insulation at ends of sleeved pipe with waterproof material.

X. Provide UL listed fire stopping, installed per manufacturer's recommendations, where pipes pass through fire rated construction.

Y. Provide nitrogen purge when brazing refrigerant piping.

Z. Install duct lining with 100% adhesive coverage and mechanical fasteners per SMACNA standards. Coat all exposed edges of lining to prevent erosion of fiberglass.

AA. Install all equipment level.

BB. Do not operate fan coils, air handlers, air conditioning units, etc. without specified filters.

CC. Do not install thermostats or temperature sensors in locations where they are subject to direct sunlight. Where thermostat or sensor are on exterior or partition walls to unconditioned space, insulate wall with minimum 1” expandable foam and seal around cable at wall.

DD. Install volume dampers or balancing devices on all supply, return, outside, and exhaust air branch ducts or air outlets (even if not shown on Drawings). Install dampers or devices so they are easily accessible without crawling through attic or crawl space.

EE. Install variable refrigerant flow (VRF) system refrigerant piping as short and direct as possible, with minimum number of joints, elbows and fittings. Piping shall be installed in a workmanship manner and parallel with the building lines unless noted otherwise.

FF. Pitch all variable refrigerant flow (VRF) system refrigerant lines towards back toward the outdoor unit unless required otherwise by the manufacturer.

GG. Label each variable refrigerant flow (VRF) system refrigerant line set to heat recovery (branch) units with fan coil it serves. Provide Seaton printed labels with 1/2" lettering or equal. Hand written labels will not be acceptable.

HH. (VRF Systems) Strictly follow manufacturer’s instructions for pressure testing, evacuation and charging of the system. Pressurize the system with 600 psi of nitrogen, and verify it maintains the pressure for 24 hours before proceeding with evacuation with a thermistor vacuum gauge installed, triple evacuate the system to 650 microns, and continue evacuation for at least one hour. With vacuum pump off, the system must hold 500 microns for 1 hour. Keep a log of the time and date of the testing for the commissioning report.

II. (VRF Systems) Keep track of the refrigerant line lengths. Verify the total line lengths are less than the scheduled line lengths. Notify the engineer if the line lengths are exceeded for verification before proceeding. Carefully calculate the refrigerant charge per the manufacturer's instructions. Keep written log of the added refrigerant change (with documentation in city multi service manual).

JJ. (VRF Systems) Flare tubing at heat recovery (branch) units and fan coil fittings shall be carefully done per MitsubishiI City Multi service manual with dimensions per table 8-2. Carefully check each flare meets this Specification. Also use refrigerant oil on the flaring tool to prevent flare splitting.

KK. All piping in trenches shall have bedding from 6 inches below pipe to 4 inches above pipe. Bedding material to be 1/4 inch min. fill sand by Canyon Rock Company or approved equivalent. Bedding must be clean and compacted so as to protect and uniformly support the pipe enclosure. Provide backfill above bedding. Backfill material specification is provided by Others. Prior to construction - verify backfill material specification with General Contractor. Bedding and backfill materials must not contain boulders, cinder fill, construction debris or materials that will damage or break the piping or cause corrosive action. Provide bedding material submittal for review and approval.

LL. A leak test must be performed for interior walls, connection between wall and ceiling, doors and any building elements between two adjacent rooms with different pressurization levels. A duct and equipment leak test must be performed on each ducted HVAC system serving spaces scheduled for pressurization. All major leaks must be eliminated before start-up of space pressurization HVAC systems.

3.2 ENERGY CODE TESTING, ADJUSTING AND REPORTING

A. The Contractor shall test and commission all mechanical equipment shown on the Mechanical Drawings. Testing and documentation shall be in accordance with manufacture's installation instructions and California Energy Code NRCC-MCH certificate of compliance forms.

B. The Contractor shall coordinate and schedule with the General Contractor, (or owner where applicable), controls contractor, other subcontractors and the owner as necessary to complete all testing in a timely manner.

C. The Contractor shall submit all completed and signed commissioning documents in one package (in PDF format) to the Mechanical Engineer of Record for review and approval. Any comments and/or corrections shall be addressed promptly, retested, and an updated report resubmitted for approval prior to completion. Provide an additional copy to the building department official where requested.

3.3 COMMISSIONING OF MECHANICAL

A. The Commissioning Agent (CxA) for this project will be appointed by the Architect or Owner. The CxA will provide the Owner's Project Requirements (OPR), Basis of Design (BOD), the commissioning plan and will prepare the final commissioning report.

B. The Contractor shall perform all the required functional performance testing and checklists, mechanical testing, adjusting and balancing (TAB), and Operation and maintenance (O & M) manuals, systems manuals, systems operations training and inspection reports as required by California Energy Code including NRCC-MCH certificate of compliance forms..

C. The Contractor shall coordinate and schedule with the General Contractor, (or owner where applicable), controls contractor, other subcontractors and the owner as necessary to complete all testing in a timely manner.

D. The Contractor shall provide written Functional performance testing and TAB reports to the Commissioning Agent (CxA) for approval. The reports shall be dated and signed by the individual responsible for performing these services. Any comments and/or corrections shall be addressed promptly, retested, and an updated report resubmitted for approval prior to completion.

3.4 REQUIREMENTS FOR ACCEPTANCE

A. Make arrangements with the Engineer and the Building Inspector to observe the Work prior to covering or enclosing the work.

B. Clean all mechanical systems to remove all contaminants. At the completion of work, provide new, clean air filters in all filter banks.

C. At completion of construction, prior to TAB air balancing, provide all systems with new filters per the equipment schedule specifications.

D. Duct pressure testing: When required by the project Title 24 Energy Documentation, provide duct pressure testing and verification reports for all duct systems. Systems shall be sealed to a leakage rate not to exceed 6% of the fan airflow or rate shown in Title 24 documentation whichever is less. Provide verification reports to Owner and building department official. All other Ductwork shall be leak-tested per CMC 603.9.2 in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. Representative sections totaling not less than 10 percent of the total installed duct area shall be tested. Where the tested 10 percent fail to comply with the requirements of this section, then 40 percent of the total installed duct area shall be tested. Where the tested 40 percent fail to comply with the requirements of this section, then 100 percent of the total installed duct area shall be tested. Sections shall be selected by the building owner or designated representative of the building owner. Positive pressure leakage testing shall be permitted for negative pressure ductwork. The permitted duct leakage shall be per CMC 603.9.2.

E. Test and balance all air moving systems and refrigeration piping systems in accordance with AABC National Standards for Field Measurements and Instrumentation. Testing shall be done by an AABC licensed TAB Contractor or independent certified NEBB Contractor which in not affiliated with a Mechanical Contractor, design Engineer or equipment manufacturer.

F. Test the Non-VRF refrigerant piping with nitrogen to 300 PSIG for 24 hours. Test the VRF refrigerant piping with nitrogen to 600 PSIG for 24 hours. If the piping fails the test, repair faulty sections and retest. Provide verification of this test along with the Test and Balance report.

G. The Contractor shall test all mechanical equipment shown on the Drawings**.** Testing and documentation shall be in accordance with manufacturer’s installation instructions and California Energy Code NRCC-MCH certificate of compliance forms.

H. The Contractor shall coordinate and schedule with the General Contractor, (or Owner where applicable), Controls Contractor, other subcontractors and the Owner as necessary to complete all testing in a timely manner.

I. The Contractor shall submit all completed and signed reporting documents in one package (in PDF format) to the Mechanical Engineer of Record and Commissioning Agent (CxA) for review and approval. Any comments and/or corrections shall be addressed promptly, retested, and an updated report resubmitted for approval prior to completion. Provide an additional copy to the building department official where requested.

J. An “as-built” red lined drawing set shall be kept on site and updated daily. These “as-builts” shall include the full scope of the design documents and specifications in this section of work. Submit “as-builts” to General Contractor and Owner.

K. Prior to job completion, submit redlined as-built drawings in PDF format (color, 200 to 300 DPI resolution) to the Engineer and Owner.

L. Provide operation and maintenance manuals on all equipment include equipment warranties certificates.

M. Instruct the Owner on how to operate and maintain all systems that are a part of this Section.

END OF SECTION

SECTION 26 05 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to provide and install the Electrical Work as shown on the drawings and as specified hereinafter, including, but not limited to the following:
   1. Electrical and telecommunications service provisions as outlined on the drawings, including temporary power for construction.
   2. Main switchboard, distribution switchboards, distribution panels, panels, transformers, circuit breakers, and feeders.
   3. Branch circuit wiring, wiring devices and connections to all equipment requiring electrical service.
   4. Lighting fixtures completely lamped, including switches, raceways and wiring.
   5. Emergency egress/exit illumination system.
   6. Central Emergency Lighting Inverter.
   7. Telecommunications system.
   8. Fire Alarm system.
   9. Mechanical equipment power connections, and motor starters where noted.
   10. Low voltage lighting control system and programming.
   11. Transient voltage suppression system.
   12. Medium voltage switchgear, transformers, and distribution system.
   13. Energy Storage system.
   14. Photovoltaic system.
   15. Clock/Speaker system.
   16. Assisted Listening System.
   17. Security System conduit rough-in.
   18. All required incidental work, such as roof flashing, electrical testing, title 24 acceptance testing, and temporary power.
   19. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the the drawings.
   20. It is the intent of the drawings and specifications that systems be complete and, except as otherwise noted, be ready for operation.

1.2 RELATED WORK

A. Division 1 - General Requirements

B. Division 9 - Finishes

C. Division 23 - Mechanical

D. Section 07270 - Firestopping

1.3 INCORPORATED DOCUMENTS

A. Requirements of the General Conditions, Supplementary Conditions, and Division 1 Sections apply to all work in this Section, unless modified herein.

B. Published specifications, standard tests or recommended methods of trade, industry or government organizations apply to work of this Section where cited by abbreviations noted below, unless modified herein.
   1. 2022 California Code of Regulations.
   2. 2022 California Building Standards Administrative Code, Part 1, Title 24, C.C.R.
   3. 2022 California Building Code (CBC), Part 2, Title 24, C.C.R. (Based on 2021 International Building Code with 2022 California Amendments).
   4. 2022 California Electrical Code (CEC), Part 3, Title 24, C.C.R. (Based on 2017 National Electrical Code with 2022 California Amendments).
   5. California Energy Code, Part 6, Title 24, C.C.R.
   6. 2022 California Fire Code (CFC), Part 9, Title 24, C.C.R. (Based on 2021 International Fire Code with 2022 California Amendments).
   7. 2022 California Green Building Standards (CALGreen) Code, Part 11.
   8. American Society of Civil Engineers 7-16 (ASCE/SEI), Minimum Design Loads for Buildings and Other Structures.
   9. Underwriters' Laboratories, Inc. (UL).
   10. Local Utility Company regulations.

C. All State and Municipal Codes and Ordinances.

1.4 CONDITIONS AT SITE:

A. Visit to site is required of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

B. Lines of other services that are damaged as a result of this work shall promptly be repaired at no expense to the Owner to the complete satisfaction of the Owner.

1.5 QUALITY ASSURANCE

A. Conformance:
   1. All work shall conform to the applicable requirements of Article 1.3 above.
   2. The Contractor shall notify the Architect, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
   3. If after contract is awarded, minor changes and additions are required by aforementioned authorities, even though such work is not shown on the drawings or covered in the specifications, they shall be included at Contractor's expense.

B. Coordination:
   1. The Contractor shall become familiar with the conditions at the job site, and with the drawings and specifications and plan the installation of the electrical work to

conform with the existing conditions and that shown and specified so as to provide the best possible assembly of the combined work of all trades.

2. The Contractor shall work out in advance all "tight" conditions, involving all trades and if found necessary, supplementary drawings shall be prepared by this Contractor, for the Architect's approval, before work proceeds in these areas. No additional costs will be considered for work, which must be relocated due to conflicts with the work of other trades.
3. The Contractor shall coordinate and verify all backbox, device, lighting fixture, or equipment mounting requirements with the devices or equipment to be installed, prior to rough in.

1.6 SUBMITTALS

A. Product Data:
   1. Comply with the provisions of Section 01 33 00 - Submittals.
   2. Within 15 days after award of the Contract, submit:
      a. Complete electrical, lighting, and signal systems material list of all items proposed to be furnished and installed under this Division. Provide manufacturers data sheets for all devices, raceways, fixtures, equipment, and related products to be used for the Division 26, 27, and 28 work.
      b. Manufacturers' specifications and other data required demonstrating compliance with the specified requirements.
      c. Manufacturers' recommended installation procedures which, when approved by the Architect, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.
   3. Shop Drawings: Furnish shop drawings and/or equipment cuts for the following:
      a. Light fixtures including lamps and ballasts
      b. Main Switchboard, distribution switchboards, distribution panels, panel boards, and transformers. Panel board submittals shall include diagrams of the circuit breaker arrangements in the panels. Arrange circuit breakers in panels exactly as shown on the panel schedules in the construction documents.
      c. Scaled drawings of equipment layout in all the electrical and telecom rooms.
      d. Fire alarm system
      e. Telecommunications system
      f. Disconnect switches
      g. Motor starters
      h. Low voltage lighting control system
      i. Central Emergency Lighting Inverter.
      j. Arc flash, Short Circuit, and Protective Device Coordination Study.
      k. Power and signal concealed service floor boxes, and furniture panel infeed boxes.
      l. Mechanical and Plumbing equipment. The Electrical Contractor shall review the Mechanical and Plumbing Submittals, and verify the voltage, wire size and overcurrent protection required. Also provide the Electrical Engineer with a copy of the submittals for their review.
      m. Transient Voltage Surge Suppression system if specified herein and/or indicated on the drawings.

n. Medium voltage switchgear, transformers, and cable if specified herein and indicated on the drawings.
o. Photovoltaic system if specified herein and indicated on the drawings.
p. Energy Storage system if specified herein and/or indicated on the drawings.
q. Clock/Speaker system if specified herein and/or indicated on the drawings.
r. Assisted Listening system if specified herein and/or indicated on the drawings.

4. Test Reports:
   a. Factory Tests: As specified for specific equipment.
   b. Field Tests: Performance tests as specified for specific equipment.
   c. Megger Tests: As specified under TESTING.
   d. When series rated circuit breakers are used, provide a letter from the manufacturer of the equipment confirming that U.L. series rating exists for all protective devices. State the available fault current from the Utility Company and indicate that the overcurrent devices exceed the available fault current at the respective point of protection.
   e. Special Seismic Certification documentation as per CBC Section 1616A and ASCE/SEI 7-16 requirements for all equipment defined as 'critical' with an importance factor of 1.5 in Paragraph 1.10.M.3 of this Section.
   f. Manufacturer's Seismic Certification or Project-Specific Design of Supports and Attachments for all other equipment and fixtures as per CBC Section 1616A and ASCE/SEI 7-16 requirements.
5. Maintenance and Operating Manuals:
   a. Systems Description: Description of operating procedures.
   b. Controls: Diagrams and description of operation of each system.
   c. Equipment: Manufacturer's brochures, ratings, certified shop drawings, maintenance data, and parts lists with part numbers. Mark each sheet with equipment identification number and actual installed condition.
   d. Materials and Accessories: Manufacturer's brochures, parts lists with part numbers, and maintenance data where applicable. Mark each sheet with identification number of system and location of installation.
   e. The Maintenance and Operation Manual shall be presented in a bookmarked PDF file with tabbed sections as stated below. Provide all information in each section as stated below.
      1) 26 2400:
         (a) Insert the approved submittals for the main switchboard and panelboards, and for medium voltage switchgear and transformers if specified herein and/or indicated on the drawings.
         (b) Provide the names, addresses and telephone numbers of the manufacturer and the two closest manufacturer's representatives of the equipment.
      2) 26 2400:
         (a) Insert the approved submittals for the transient voltage surge suppression equipment.
         (b) Insert all operating instructions.
         (c) Provide the names, address and telephone numbers of the manufacturer and the closest manufacturer's representative of the equipment.

(d) Include the manufacturer's recommended maintenance of the equipment.

3) 26 5101:
   (a) Insert the approved submittals for the light fixtures.
   (b) Highlight the lamp type that was installed for each light fixture.
   (c) Provide the names, address and telephone numbers of the manufacturer and the closest manufacturer's representative for each light fixture.
4) 26 5101:
   (a) Insert the approved submittals for the motion sensing light control equipment.
   (b) Insert all operating instructions.
   (c) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
   (d) Include the manufacturer's recommended maintenance of the equipment.
5) 26 5700:
   (a) Insert the approved submittals for the low voltage lighting control equipment.
   (b) Insert all operating instructions.
   (c) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
   (d) Include the manufacturer's recommended maintenance of the equipment.
6) 27 0000:
   (a) Insert the approved submittals for the telecommunications system.
   (b) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
   (c) Include the manufacturer's recommended maintenance of the equipment.
7) 28 3101:
   (a) Complete the “Record Of Completion” entirely.
   (b) In the “Download File” indicate the exact equipment that the Monitor Modules are monitoring. i.e. fire sprinkler flow switches, tamper switches, etc..
   (c) Simplify the Download File so that it coincides with the submitted and approved fire alarm single line diagram.
   (d) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
   (e) Include the manufacturer's recommended maintenance of the equipment.
   (f) Insert an abbreviated data sheet that states how to test, reset and silence the fire alarm system.

(g) Insert the name and telephone number of the Central Station that receives the alarms, and the proper sequence to follow during an alarm.

8) 26 05 13:
   (a) Insert the approved submittals for the medium voltage distribution system.
   (b) Provide the names, addresses and telephone numbers of each manufacturer and the two closest each manufacturer's representatives.
9) 26 12 02:
   (a) Insert the approved submittals for the medium voltage transformer.
   (b) Provide the names, addresses and telephone numbers of each manufacturer and the two closest each manufacturer's representatives.
10) 26 0800:
   (a) Insert all systems testing results.

6. Record Documents: "As-builts": As specified under Paragraph 3.2 of this Section.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all trades.

B. Delivery and Storage: Deliver all materials to the job site in their original containers with all labels intact and legible at time of use. Store in strict accordance with approved manufacturers' recommendations.

C. Replacements: 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.

D. This Contractor shall personally, or through an authorized representative, check all materials upon receipt at jobsite for conformance with approved shop drawings and/or plans and specifications.

1.8 SCHEDULING/SEQUENCING

A. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet the construction schedule, together with any special handling charges, shall be borne by this Contractor.

B. The Contractor shall coordinate production and delivery schedule for all Owner-supplied equipment with the equipment suppliers to ensure that all Owner-supplied equipment is delivered to site in coordination with the construction schedule and in such a manner as to cause no delays in completion of the Contract as scheduled.

1.9 REQUIREMENTS

A. The contract drawings indicate the extent and general arrangements of the conduit wiring systems, etc. If any departures from the contract drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable, and within thirty-five (35) days after award of the electrical contract.

B. Unless material list and data is received as a complete and all-inclusive submittal within the stipulated time all items shall be provided as specified, with no deviations permitted.

C. Any and all additional costs incurred by the substitution of electrical material or equipment, or installation thereof, whether architectural, structural, plumbing, mechanical or electrical, shall be borne by the Contractor under this Section.

D. Burden of proof of equality of any substitution for a specified product is the responsibility of this Contractor.

E. Where required by Architect to ascertain equality of substitute product, Contractor may be requested to provide the specified item and the submitted substitution for comparison, at no additional cost to the Owner.

1.10 DESCRIPTION OF DEMOLITION AND REPLACEMENT WORK

A. This project includes the demolition and replacement, modification, or enhancement of existing facilities. As such, the project scope for this contractor shall include all associated electrical, lighting, and signal system upgrades and demolition/removal work at the existing buildings(s) and/or site. The intent is that all systems will be complete and functional at the completion of this contract and that all old systems, equipment, feeders, circuits, wiring, and related devices (no longer used) be completely and neatly removed. Where discrepancies between the drawings and existing conditions are noted, the Architect or Owner shall be notified immediately for resolution.

B. As with every renovation project, the electrical work will include (and require) exploration and other field work on a daily basis to complete the new designed equipment and connections within the constraints of the existing building and existing site conditions.

C. The contractor shall include as part of the base bid, sufficient labor hours to provide such exploration and field work throughout the duration of the project. Change orders for miscellaneous coordination of existing conditions will not be approved unless specific and latent conditions are uncovered that warrant such additional compensation or require additional work not shown on the drawings or included in the specifications, or implied by the designed conditions.

D. New raceways and wiring to new and renovated equipment are to be installed unless otherwise noted. Where raceways are installed in accessible concealed locations (i.e. unfinished spaces or electrical / mechanical / attic spaces), EMT with wire shall be used. Where new wiring is required to be routed through existing walls and ceilings

that cannot readily be accessible for new conduit, MC cable or flex conduit and wiring may be installed, fished through and secured in each space as required by Code. Non-metallic sheathed cable shall not be utilized on this project.

E. All new raceways shall be installed concealed and all new equipment installed flush, unless otherwise noted on the drawings or in these specifications.

1.11 GUARANTEE

A. This Contractor shall guarantee that all work executed under this Section will be free from defects of materials and workmanship for a period of one (1) year or as per the General Conditions of this project, whichever is longer. Dates shall be from the date of final acceptance of the building. The contractor shall further guarantee that he will, at his own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the guarantee. Such repair or replacement shall be guaranteed for one (1) year from the date of repair or replacement.

1.12 PERMITS AND INSPECTIONS

A. This Contractor shall arrange for and obtain all required permits and inspections.

B. Do not allow or cause any of the work to be covered or enclosed until it has been tested and/or inspected.

1.13 IDENTIFICATION

A. Switchgear, switchboards, distribution panels, and feeder circuit breakers therein, panels, disconnect switches, motor starters, transformers, motor disconnect switches, cabinets, and other apparatus used for the operation of, or control of circuits, appliances or equipment, shall be properly identified by means of engraved laminated plastic descriptive nameplates mounted on apparatus using stainless steel screws. Nameplates shall have white letters with black background and be submitted to the Architect for approval. Cardholders in any form are not acceptable.

B. Provide p-touch style labeling of circuit designations for all receptacles on the project.

C. Each branch circuit of panel boards to have a permanently fixed number with load directory, mounted under celluloid on inside of cabinet door, showing circuit numbers and typewritten description of equipment supplied by breakers. Where changes are made to existing panelboards, newly typewritten circuit directories shall be prepared to replace existing directories.

D. Provide label on all motors: "Caution. Automatic equipment. May start at any time."

E. Provide silk-screened or engraved identification labels on all switch box covers identifying specific loads that are not readily apparent to the user, including electroshades, projection screens, exhaust fans, audio-visual controls, etc.. Submit proposed labels to Architect for approval prior to manufacture of labels.

F. Provide identification of all pull boxes, junction boxes, and conduit stub-ups on the project as outlined below:
   1. For Power Feeders:
      a. Stencil cover with identifying circuit number.
      b. Lettering 1" high.
      c. Color of lettering black.
      d. Place lettering on cover in neat manner; run parallel to long sides of box.
   2. For branch circuits, grounding, communication, signal, and control systems boxes and blank conduit stub-outs:
      a. Paint inside back of each j-box, front of each cover, and ends of each blank conduit stub-out with identifying system color as listed below:

1)	277/480-volt	Orange
2)	120/208-volt	Blue
3)	Telephone/Data	Grey
4)	Ground system	Green
5)	Fire Alarm	Red
6)	Lighting control	Orange/White
7)	Clock/Speaker	Brown
8)	Audio/Visual	Yellow
9)	Security	White
10)	Emergency Power 277V	Orange/Red
11)	Emergency Power 120V	Blue/Red

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to applicable Division 26, 27, and 28 Sections for complete products specifications.

2.2 MATERIALS

A. Materials of the same type or classification, used for the same purpose, shall be the product of the same manufacturer.

2.3 ACCEPTABLE MANUFACTURERS

A. Materials shall be of make mentioned elsewhere in this specification. All materials shall be the best of their several kinds, perfectly new and approved by the Underwriters' Laboratories.

B. Where material, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards of desired quality, style and utility and shall be the basis of the bid. Materials so specified shall be furnished under the contract unless changed by written approval of the Architect. Where two or more designations are listed, choice shall be optional with this Contractor, but this Contractor must submit his choice for final approval.

2.4 POSTED OPERATING INSTRUCTIONS

A. Furnish approved operating instructions for systems and equipment where indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment. Provide weather-resistant materials or weatherproof enclosures for operating instruction exposed to the weather. Operating instruction shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

2.5 CATALOGED PRODUCTS/SERVICE AVAILABILITY

A. Materials and equipment shall be current products by manufacturers regularly engaged in the production of such products. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The 2-year period shall be satisfactorily completed by a product for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished. The equipment items shall be supported by service organizations which are reasonable convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which the work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Drawings:
   1. The general arrangement and location of wiring and equipment is shown on the electrical drawings and shall be installed in accordance therewith, except for minor changes required by conflict with the work of other trades.
   2. The Contractor shall coordinate and verify all backbox, device, lighting fixture, or equipment mounting requirements with the devices or equipment to be installed, prior to rough in.

3. Drawings indicate the circuit and panel which supplies each device or fixture. Provide and install conduit and conductors to make all connections from panel to nearest device and from first device to additional devices on same circuit. Conduit size and fill shall satisfy NEC requirements. Two or three different phases supplied by a 3-phase panel may share a single neutral only if circuit positions are adjacent in the panel. Do not exceed 4 #12 or 3 #10 conductors in a ½" conduit, 7 #12 or 5 #10 in a 3/4" conduit, and 11 #12 or 9 #10 in a 1" conduit, unless otherwise noted. Provide common handle-tie on breakers for multi-wire branch circuits (with common neutral), per NEC. If more than three current carrying conductors are installed in one conduit, conductor size shall be increased as required per NEC. Do not share neutrals for branch circuit runs to electronic equipment or where noted on the drawings.
4. Drawings indicate the location of all light switches. Where fixtures in a room are controlled by more than one switch, the same lower case letter is drawn adjacent to a switch and each fixture controlled by that switch. Where no lower case letter is adjacent to a switch, all fixtures in the room are controlled by that switch. Provide and install conduit and wire from fixture to switch and between fixtures as required to accomplish switching shown. Do not route branch circuit wiring for light fixtures through switch boxes. Where dimming controls are specified, provide required dimming control wiring in addition to power wiring from control device to all controlled light fixtures. Provide separate conduit for dimming control wiring unless otherwise indicated on the drawings.
5. Drawings indicate location of all signal outlet boxes. Provide and install conduit system as required and complete system wiring, unless otherwise noted.
6. Control wiring is generally not shown on the plans. Contractor shall refer to control diagrams and provide and install all wiring and raceways required to make all interconnections.
7. All branch circuit wiring No. 12 or No. 10 as noted, all control wiring No. 14, except as noted next to "slash marks" on the drawings, or as noted under "Wire," as specified herein.
8. All dimensions, together with locations of doors, partitions, etc. are to be taken from the Architectural Drawings, verified at site by this Contractor.
9. Maintain "as-built" records at all times, showing the exact location of concealed conduits and feeders installed under this contract, and actual numbering of each circuit. Upon completion of work and before acceptance can be considered, this Contractor must forward to the Architect, updated CAD plans, corrected to show the electrical work as actually installed.
10. All standard 20A branch circuit conductors shall be #12 minimum for up to 75 linear circuit feet, #10 minimum for up to 150 linear circuit feet, and #8 for runs longer than 150 feet.

B. Measurements: Before ordering any material or closing in any work, verify all measurements on the job. Any differences found between dimensions on the drawings and actual measurements shall be brought to the Architect's attention for consideration before proceeding.

3.3 FIELD QUALITY CONTROL

A. All workmanship shall be first class and carried out in a manner satisfactory to and approved by the Architect.

B. This Contractor shall personally, or through an authorized and competent representative, constantly supervise the work and so far as possible keep the same foreman and workmen on the job throughout.

3.4 COORDINATION

A. In electrical rooms, where electrical equipment is located at walls with brace framing, provide and install steel channel supports for mounting of electrical equipment away from wall to avoid conflict with brace framing. Steel channel supports shall be unistrut or equal, and shall include all channels, bases, fittings, etc., as required for a complete installation.

B. In electrical rooms, Contractor is responsible for installation of electrical equipment within the space provided. Contractor shall provide ¼" scale plans of electrical room layouts, and elevations of steel channel supports (where used or required) of electrical equipment for review and approval prior to any installation or rough-in

3.5 INSTALLATION/APPLICATION/ERECTION

A. All electrical raceways and devices shall be installed concealed (for raceways) and/or flush mounted (for devices), unless otherwise noted. Provide cut-in boxes and "fish" flexible MC or flex conduit and wire through existing walls to remain, unless shown otherwise on plans. Cut and patch to facilitate such installation to match adjacent and original finish.

B. All cutting, repairing and structural reinforcing for the installation of this work shall be done by the General Contractor in conformance with the Architect's requirements.

3.6 EMERGENCY POWER SOURCES

A. All emergency source circuits shall be installed in separate raceways (from normal power), per 2017 NEC 700.10(B), or the applicable code at the time of permitting.

3.7 TEMPORARY LIGHTING AND POWER

A. Provide and install temporary lighting and power systems for the duration of construction, of adequate size to accommodate the required lighting and power loads. Coordinate with other trades to insure adequate sizing.

B. Provide distribution equipment as required to support all construction activities.

3.8 FIRE STOPPING AND FIRE RATED PENETRATIONS

A. All electrical equipment mounted in, on, or through fire rated construction shall be installed to maintain the fire rating of the construction.

B. Provide fire rated pads (or other suitable assembly) around all electrical junction boxes in fire rated walls/ceilings/floors to maintain the fire rating.

C. Provide fire rated construction around all recessed light fixtures and/or panel board / cabinets mounted flush in fire rated walls to maintain the fire rating. Coordinate depth of construction with other trades to avoid conflicts.

D. Conduit sleeves shall be provided as a means of routing cables through fire-rated walls or floors. Openings in sleeves and conduits used for system cables and those which remain (empty) spare shall be sealed with an approved fireproof, removable sagging material. Sleeves which pass vertically from floor to floor shall be sealed in a similar manner using an approved re-enterable system. Additional penetrations through rated assemblies necessary for passage of tel/data wiring shall be made using an approved method and permanently sealed after installation of cables.

3.9 ADJUSTING AND CLEANING

A. All electrical equipment, including existing equipment not "finish painted" under other sections, shall be touched up where finished surface is marred or damaged.

B. All equipment, lighting fixtures, etc., shall be left in clean condition, with all shipping and otherwise unnecessary labels removed there from.

3.10 SCHEDULES

A. Coordination: Coordinate installation of electrical items with the schedule for other work to prevent unnecessary delays in the total Work.

3.11 WARNING SIGN MOUNTING

A. Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.12 PAINTING OF EQUIPMENT

A. Factory Applied: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.20.

B. Field Applied: Paint electrical equipment as required to match finish or meet safety criteria. Painting shall be as specified in the respective equipment section.

3.13 TESTS

A. Testing and inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 05 13

MEDIUM VOLTAGE DISTRIBUTION

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American National Standards Institute (ANSI) Publication (Latest Edition):

C2 National Electrical Safety Code

C. Institute of Electrical and Electronic Architects, Inc. (IEEE) Publication (Latest Edition):

48 Standard Test Procedures and requirements for Alternating Current Cable Terminations 2.5kV through 765kV

386 Separable Insulated Connectors for Power Distribution Systems

400 Field Testing and the Evaluation of Insulation for Shielded Power Cable Systems

D. National Fire Protection Association (NFPA) Publication (Latest Edition):

70 National Electrical Code (NEC)

E. Underwriter's Laboratories, Inc. (UL) Publications (Latest Edition):

UL 1072

F. State of California Public Utilities Commission (Cal. P.U.C.) Publication:

G.O. 128 Rule for construction of Underground Electric Supply and Communication Systems.

G. AEIC CS6-96: Specifications for Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 69 kV

H. ASTM B8-04: Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

I. ICEA S-93-639/NEMA WC74: Shielded Power Cables Rated 5 - 46 kV

J. ICEA S-97-682: Utility Shielded Power Cables Rated 5 - 46 kV

1.2 SUBMITTALS

A. Submittals: Submit the following information for approval:
   1. Manufacturer's Data and Shop Drawings:
      a. Conduit
      b. Medium Voltage Cables
      c. Medium Voltage Splice Kits
      d. Medium Voltage Terminating Kits
      e. Medium Voltage Connectors
      f. Terminators
      g. Fault Indicators
   2. Manufacturer’s and Installer’s Experience: Submit evidence documenting manufacturer’s ten-year experience in medium voltage cable and accessories manufacturing. Submit manufacturer's data on electrical cable and terminations. Contractor shall submit a list of previous work evidencing at least five years experience in medium voltage cable installation of similar type. Submit name and experience record of each person to be engaged in medium voltage cable work. Only those persons accepted by the Owner will be permitted to engage in medium voltage cable work.
   3. Cable Test Reports:
      a. Three copies of factory test records on a per-reel basis shall be furnished at the time of cable shipment. The data shall include the following items: Purchase order and date; description of cable; description of sample high voltage test; dielectric loss and P.F. test; bending test; marked length and actual conductor resistance at 25 degrees C.; insulation resistance in megohms at the testing temperature of each reel length of cable or insulation resistance in megohms at the standard temperature of 15.5 degrees C. per 1000 feet of the cable supplied in this order; sheath integrity and thickness.
      b. The maximum current carrying capacities and maximum safe operating temperatures on the basis of 3 equally loaded single conductor cables in underground ducts at 100 percent and at 75 percent load factors, and on the basis of 90 RHO, 20 degrees C. ambient and 80 degrees C. conductor temperatures, shall be stated. (Three cables in one duct.)
   4. Certificates:
      a. Workmen's Competency: Submit high voltage cable Splicer/Terminator certification of competency and experience 30 days before splices or terminations are made in high voltage cables. Splicer/Terminator experience during the immediate past 3 years shall include performance in splicing and terminating cables of the type and classification being provided under this contract.
      b. Before assigning any cable splicer to work covered by this specification, the Contractor shall provide the Owner with the names of the cable splicer to be employed, together with satisfactory proof that each splicer has had at least 3 years experience in splicing high-voltage cables and is experienced with the type and rating of cables to be spliced.

5. Contractor to submit a medium voltage cable pulling plan complete with calculations and layout. Cable pulling plan shall include but not be limited to the actual calculations of jam ratios, sidewall bearing pressures and maximum pulling tensions using pulling eyes or cable grips for each run. Also, provide cable information on the plan and diagram of each pull run.
6. Contractor to provide submittal of lubricants.
7. Submit shipping and handling protocol.

1.3 COORDINATION AND SCHEDULING

A. Coordinate with the Owner for the interception of existing underground medium voltage distribution conductors where indicated on the drawings. Comply with all Owner requirements for splicing and rerouting of existing conductors.

B. It is the responsibility of the Contractor to arrange for all services with the Owner and to ensure that all conduit and other service provisions are as required by the Owner prior to installation of these service provisions. No extra payments will be made to the Contractor as a result of his failure to fully coordinate with the Owner.

C. Location of existing utilities: Although the Architect has endeavored to show all underground or above ground utilities at the project site, all utility locations are not necessarily known nor shown. The Contractor is cautioned that the utilities encountered at the site include communication cables and electrical cables conducting high voltage, as indicated. When excavating in the vicinity of such cables, special precautions are to be observed by the Contractor at his own cost and shall include the following: All cables and their enclosure ducts shall be exposed by careful hand excavation so as not to damage the ducts or cables nor cause injury to persons, and suitable warning signs, barricades, and safety devices shall be erected whenever necessary or appropriate.

D. Provide schedule notification to the Owner 5 working days prior to medium voltage testing.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials and equipment shall conform to the Owner's Standards and to the specifications herein. Electrical ratings shall be as indicated.

2.2 MATERIALS

A. Conduit:
   1. See Section 26 27 00.

B. Tape: UL 510. Plastic insulating tape shall be capable of performing in a continuous temperature environment of 80 degrees C.

C. Power Wire and Cable:
   1. Wire and Cable Conductor Sizes: American Wire Gauge (AWG) designates wire and cable conductor sizes. Conductors shall be copper. Insulated conductors

shall bear the date of manufacture imprinted on the wire insulation with other identification. Wire and cable manufactured more than 6 months before delivery to the job site shall not be used. Provide conductor identification within each enclosure where a tap, a splice or a termination is made.

D. Medium Voltage Wires and Cables: 15KV single conductor, Class B concentric stranded copper, compact round type, bare or annealed uncoated copper per ASTM B-496, size as noted on the drawings. Underwriters' Laboratories shall list Cable as 15,000-volt power cable type MV-105, the cable shall bear the U.L label, and shall be rated for installation in wet or dry conditions. Cables shall be designed to operate continuously at 105 degrees C for normal operation; 140 degrees C for emergency overload conditions, and 250 degrees C for short circuit conditions.
   1. Strand Screen: Extruded semi-conducting EPR (ethylene propylene rubber) layer over conductors.
   2. Insulation: The insulation shall be type EPR, 133 percent insulation level, 220 mils.
   3. Insulation Screen: The insulation shall be screened by an extruded semi-conducting EPR layer. The thickness shall be in accordance with the referenced standards.
   4. Shield: 5 mil bare copper tape helically applied with 12.5% nominal overlap.
   5. Medium voltage shield drain wrap half-lapped shall not exceed 12.5%.
   6. Outer jacket: Black polyvinyl chloride jacket, 80 mils, surface printed, water, oil, alkali, and sunlight resistant.
   7. Strand Screen, Insulation, Insulation Screen, and Jacket shall meet ICEA S-93-639 / NEMA WC74, ICEA S-97-682, AEIC CS8 and U.L 1072 standards.
   8. The manufacture, reeling, testing, certification and shipping of this cable shall be in accordance with IEEE-48 standards.
   9. All factory serial numbers of reels and all other markings must match identically with those shown on the Factory test certificates.
   10. Each reel must have one pulling-eye attached to outer cable end.
   11. Medium voltage conducting thermosetting compound shall be compatible with both the insulation and the conductor and have an allowable operating temperature equal to that of the insulation.
   12. Cable ratings shall include medium voltage emergency overloads for up to 1,500 hours cumulative through the life of the cable.
   13. The cable must be free stripping without the use of heat cutting or the need of machine removal.
   14. Cable Warranty: 40 years from date of shipment.
   15. Provide stranded copper ground conductor in each conduit with phase conductors. Size for ground conductor shall be as indicated in Section 26 24 00 or on the drawings.

E. Terminations and splices shall be rated as follows:

Voltage:	BIL: 110kV, 1.2 X 50 microseconds
Withstand:	50kV, 60 Hz, 1 minute
	75kV, DC, 15 minutes
Corona:	19 kV extinction
Current:	Continuous: equal to cable ampacity - see drawings
	8-hour overloaded: 150% of cable ampacity

Momentary:	25,000 amps, RMS, 12 cycles
	10,000 amps, RMS, 0.5 second
	3,500 amps, RMS, 3.0 seconds
Production Tests:	Applied Potential: 50kV, 60 Hz, 1 minute
	Corona: 19kV extinction
	Test Point: Verify operation

F. Medium Voltage Terminations (Indoor):
   1. Medium Voltage Cable Terminations: IEEE 48 Class 1. The manufacturer shall provide all components, materials and complete instructions for installations, which shall include stress relief devices.
   2. Terminators: Shall be modular, molded rubber type: IEEE 48 Class I. Provide terminator as specified herein for terminating single conductor, solid insulated, nonmetallic jacketed type cables for service voltage up to 15 KV. The terminator shall consist of stress control, ground clamp, non-tracking rubber skirts, crimp-on connector, rubber cap, and serial lug. Separate parts of copper or copper alloy shall not be used in contact with aluminum or aluminum alloy parts in the construction and installation of the terminator.

G. Medium Voltage Terminations (Outdoor):
   1. Terminators shall be 600 ampere, non-loadbreak, separable elbow type, Elastimold Type 655LR or equal, with shield terminator with appropriate shield adapt kit.
   2. Terminators shall be fully shielded, fully submersible, designed for energized operation.
   3. Terminators shall be of the materials and construction to ensure dead front construction, shielding, and proper creep path length and water seal. An integral voltage test point and a reinforced pulling ring of stainless steel shall enable the elbow connector to be removed with a shotgun tool. The crimp-type connector for the cable conductor shall meet all requirements of TDJ-162 for Class "A" connectors. A copper pin incorporating Belleville washers at the engagement point with conductor contact shall ensure the integrity of the electrical connection and result in the total connector system meeting Class "A" connector requirements. A stainless steel hold down bail shall mechanically lock the elbow connector onto the bushing.
   4. All separable connectors and junctions shall comply with IEEE-386.

H. Splices: Splicing shall be allowed only with the prior permission of the Owner and will be allowed only if cable cannot be installed in one continuous piece without splice. Splices shall be made using a "kit" which shall be the product of one manufacturer and shall have the approval in writing of the manufacturer of the cable, which is to be spliced. Splice shall be suitable for continuous immersion in water. Kit shall be modular, molded rubber type, and shall be as manufactured by Raychem HVS-1520S Series for Heat-Shrinkable splice and Elastimold 655LR Series Separable Connector for elbow splice, or approved equal.
   1. Molded Kits shall be fully shielded, fully submersible, designed for energized operation.
   2. Connectors shall be shielded, with proper creep path length and water-seal. The crimp-type connector for the cable conductor shall meet all requirements of TDJ-162 for Class "A" connectors.

I. Fault Indicators:
   1. At elbow connectors provide and install Cooper Power Systems Type TPR or approved equal test point reset fault indicators. Fault indicators shall not trip due to mechanical forces caused by handling. An electric pulse shall turn the indicator's display. When line voltage is restored, the indicator shall reset in approximately 3 minutes. A semi-conductive molded rubber housing, epoxy encapsulated electronic componentry and sealed target window shall make indicator suitable for submersible applications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable installation shall conform to NFPA 70 and ANSI C2:
   1. Ends of cable shall be taped immediately after cutting to prevent moisture from entering the cable. Where the cable is not expected to be connected for at least 72 hours, the tape shall also be varnished.
   2. Cables shall be in one piece without splices between connections except where the distance exceeds the lengths in which the cable is furnished.
   3. Bends in cables shall have an inner radius not less than 12 times the cable diameter.
   4. Leave a horizontal slack of approximately 3 feet on each end of cable runs, on each side of connection boxes, and at all points where connections are brought to equipment. Leave additional slack to make necessary connections.
   5. Ground cable shielding, metallic sheath, and armor at each cable joint or splice by means of braided tinned copper wire connected to equipment grounding conductor. See Section 26 24 00. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground wires shall be neatly and firmly attached to pullbox walls and the amount of exposed bare wire shall be held to a minimum.

B. Cable Pulling: Test raceways with a mandrel and thoroughly swab out to remove foreign material before the pulling of cables. Pull cables down grade with the feed-in point at the pullbox or equipment enclosure of the highest elevation. Use flexible cable feeds to convey cables through the pullbox opening and into the raceway runs. Cable slack shall be accumulated at each junction box where space permits by training the cable around the interior to form one complete loop. Minimum allowable bending radii shall be maintained in forming such loops.
   1. Lubricants for assisting in the pulling of jacketed cables shall be those specifically recommended by the cable manufacturer. Cable lubricants shall be soapstone, graphite, or talc for plastic jacketed cables. The lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.
   2. Cable pulling tensions: Use a dynamometer and do not exceed a value of TM = number of conductors in the run, times the cross sectional area in circular mills, times the constant .011, or the maximum pulling tension recommended by the cable manufacturer, whichever is lower.
   3. Installation of Cables in Pullboxes: Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum

spare cable lengths. Form all cables to closely parallel walls, not to interfere with conduit entrances, and support on brackets and cable insulators at a maximum of 18 inches separation. Support cable splices by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space opening for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each pullbox.

4. Use nylon or manila rope.
5. Cable racks, supports and related fittings to be UL listed, cable iron insulators to be dry processed glazed porcelain, use industry standard equipment.

C. Observation by Owner's representative: pulling set up and approved pulling plan, pulling operation.

D. Cable Terminating: Protect terminations of insulated power cables from accidental contact, deterioration of coverings and moisture by the use of terminating devices and materials. Install all terminations of insulated power cables, cable splices, and high voltage terminations in accordance with the manufacturer's requirements. Make terminations using materials and methods as indicated or specified herein or as designated by the written instructions of the cable manufacturer and termination kit manufacturer.

E. Splices in Medium Voltage Cables: Splices shall be made only in pullboxes and only where approved in advance by the Owner. Splices in Shielded Cables: Splices in shielded cables shall include covering the spliced area with metallic tape, or like material, to the original cable shield and by connecting it to the cable shield on each side of the splice. Provide a copper ground connection as part of the splice installation. Wire shall be trained to the sides of the enclosure in a manner to avoid interference with the working area.

F. Cable in Underground Duct:
   1. The duct shall have a minimum slope of 3 inches in each 100 feet away from buildings and toward manholes and other necessary drainage points, and shall run in straight lines except where a change of direction is necessary. As each conduit run is completed, a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the inside diameter of the duct shall be drawn through the duct; after which a brush, having stiff bristles, shall be drawn through until the conduit is clear of all particles of earth, sand or gravel; conduit plugs shall then immediately be installed. Provide a plastic warning tape in the backfill approximately 12 inches below grade. The tape shall be yellow plastic with integral warning legend repeated continuously throughout the entire length of the tape.
   2. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter, a minimum radius of 36 inches for ducts of 3 inches in diameter and larger, and a minimum of 48 inch radius for medium voltage applications.

3. Use end bells where duct lines enter pullboxes or handholes and rigid steel exposed in pullboxes or handholes. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs.
4. Removal of Ducts: Where duct lines are removed from existing manholes, close the openings to waterproof the manhole. Chip out the wall opening to provide a key for the new section of wall.
5. Multiple duct runs shall maintain 3-inch minimum separation between runs. Provide plastic spacers at maximum 5 feet-0 inch centers to maintain 3 inch spacing between conduits. Drive two reinforcing bars to anchor the conduits at 10 feet-0 inch centers to prevent floating during concrete pour.
6. Do not install plastic conduit in rock base. Provide double wrapped galvanized rigid steel elbows on runs greater than 100 feet or on runs with more than two 90-degree elbows.
7. Install 3” minimum concrete encasement on duct banks that include two or more raceways in a single trench. Drive two reinforcing bars to anchor the conduits at 10 feet-0 inch centers to prevent floating during concrete pour.
8. Burial depth - Concrete encased: 30-inch minimum for 600V or lower systems to top of concrete encasement.
9. Color mix on medium voltage ductbanks to be 10-lbs red oxide per yard of concrete.
10. Manholes shall be left in a clean condition with all debris removed and with all cables supported on approved cable supports. All stubs for manholes shall be concrete encased and shall extend 5 inches beyond manholes.
11. Underground Structures: Precast concrete - risers and tops to conform to ASTM C 478. Precast units (ACI 318) shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete pullboxes. Pullboxes shall be the type noted on the drawings. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Duct entrances and windows shall be located near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair their strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide all necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. A pulling-in iron shall be installed in the wall opposite each duct line entrance. The words "HIGH VOLTAGE" and “M.H.-XX” (confirm manhole number with Owner) shall be cast in, or welded on, the top of pullbox cover - see drawings for details. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable. All steel covers, frames, and steel fittings shall be galvanized. Penthead security bolts shall secure steel cover.
    a. Metal Frames, Covers and Gratings: Full traffic covers shall satisfy the ASSHTO H-20 loading criteria, and pedestrian traffic covers shall satisfy the ASSHTO H-10 loading criteria.
    b. Drainage Pipe and Fittings: Cast-iron, extra strength. Drains shall be cast-iron, coated or uncoated, plain pattern, bottom outlet with perforated or slotted hinged cover.

G. Transformer or Concrete Pullbox Grounding: See Section 26 24 00. Install ground rod in manholes and in transformer compartment, and connect properly to the cable shielding, metallic sheath, and armor at each cable joint or splice by means of braided tinned copper wire. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations.

3.2 LABELING

A. Label medium voltage conductors, splices, and terminations as per Section 26 05 00 and as detailed on Drawings.

3.3 SERVICES INSTALLATION

A. Electric Service: Arrange with the Owner for scheduling of splicing into existing medium voltage site distribution system where indicated on the drawings. Furnish and install all materials and labor necessary for complete installation as noted on drawings, and as required by the Owner.

3.4 EARTHWORK

A. See Section 26 27 00.

3.5 TESTING

A. Perform inspection and tests per NETA ATS-2017 Section "Cables-Medium Voltage-69kV Maximum" and per Owner’s requirements.

B. All medium voltage cables, cable splices, junctions and jumpers shall be subjected to dielectric-absorption and high voltage test after the installation has been completed.

C. Provide schedule notification to the Owner 5 working day prior to testing.

D. Each medium voltage power cable shall be tested with a 2,500 volt insulation resistance test set and readings recorded each 15 seconds for the first 3 minutes until fully charged and then at 1 minute intervals for 3 minutes with a minimum reading of 200 megohms at 60° F and corrected accordingly at all other temperatures.

E. For each medium voltage cable: An initial voltage shall be applied and increased in no less than 5 uniform steps up to the maximum test voltage for 15 KV system to 63 KVDC and hold for 5 minutes.

F. Ensure that terminator voltage limits are not exceeded. Investigate any readings exceeding 10 micro-amps for every 1,000 feet of cable.

G. Perform a shield continuity test on each power conductor by ohmmeter method. Contractor to investigate resistance values in excess 10 ohms per 1,000 feet of cable.

H. All cables failing tests or with evidence of damage shall be removed and replaced in their entirety (no splices), at no cost to the Owner.

I. Contractor shall assist in testing by providing test equipment, labor and technical personnel.

J. Contractor to provide equipment that will allow for proper bailing to avoid premature connection failure.

K. Test Fault Indicators and verify correct operation per Manufacturer's instructions.

L. See Section 26 08 00 for additional requirements.

END OF SECTION

SECTION 26 08 00

TESTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included in This Section: All materials, labor, equipment, services, and incidentals necessary to perform the testing and inspection of the electrical work, including but not limited to the general systems noted below:
   1. Grounding system.
   2. Lighting system.
   3. Distribution system.
   4. Fire Alarm system.
   5. Lighting control system.
   6. Lighting emergency inverter system.
   7. Telecommunications system.
   8. Title 24 Acceptance Testing.
   9. Test additional work where specified in other Sections of these specifications or where indicated on the drawings (provide all materials, labor, equipment, services, and incidentals necessary to perform the testing and inspection of this Electrical Work):
      a. Medium voltage switchgear, transformers, and distribution system.
      b. Energy Storage system.
      c. Photovoltaic system.
      d. Clock/Speaker system.
      e. Security system rough-in.
      f. Assisted Listening system.
      g. Close-out photographs.
   10. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.
   11. All work shall comply with Sections 26 05 00 and 26 27 00.
   12. In addition to the general system tests and inspections indicated above, the Contractor shall perform the following inspections and tests. The Contractor shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections:
      a. System Grounding.
      b. Switchgear, Switchboards, Distribution Panels, Panelboards.
      c. Feeders.
   13. The purpose of these tests is to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

1.2 APPLICABLE CODES, STANDARDS, AND REFERENCES

A. All inspections and tests shall be in accordance with the International Electrical Testing Association - Acceptance Testing Specifications ATS-2021 (referred to herein as NETA ATS-2021).

1.3 QUALIFICATIONS

A. Qualifications of the Testing Firm shall be as listed in NETA ATS-2021.

PART 2 - PRODUCTS

2.1 THIS ARTICLE DOES NOT APPLY TO TESTING.

PART 3 - EXECUTION

3.1 GENERAL

A. Final test and inspection to be conducted in presence of the Authority having Jurisdiction (AHJ) or Inspector of Record (IOR). Test shall be conducted at the expense of, and managed by, the Contractor, at a mutually agreed time. Submit written test report of all tests, with test result values and overall outcome.

B. All portions of the electrical installation shall be inspected and tested to ensure safety to building occupants, operating personnel, conformity to code authorities and Contract Documents, and for proper system operation.

3.2 INSPECTIONS AND TESTS

A. Tests: Field tests shall be performed and reports submitted, as per Section 26 05 00, Part 1.
   1. Final Inspection Certificates: Prior to final payment approval, deliver to the Owner, with a copy to the Architect, signed certificates of final inspection by the appropriate local authority having jurisdiction.
   2. Grounding System:
      a. All ground connections shall be checked and the entire system shall be checked for continuity. The resistance of grounding electrodes in the system shall be measured using a 3 point fall-of-potential method. The maximum ground resistance shall be three ohms. If the measured ground resistance exceeds three ohms, install (1) additional ground rod, bonded and interconnected with the grounding electrode system.
      b. Ground tests shall meet or exceed the requirements of the National Electric Code.
   3. Lighting Systems:
      a. The interior and exterior lighting systems shall be checked for proper local controls and operation of entire installation, including the operation of the low voltage lighting control system.

4. Power Distribution System:
   a. Test main switchboard, distribution boards, panel boards, and transformers for grounds and shorts with mains disconnected from feeders, branch circuits connected and circuit breakers closed, all fixtures in place and permanently connected and grounding jumper to neutral lifted and with all wall switches closed.
   b. Test each individual circuit at each panelboard with equipment connected for proper operation. Inspect the interior of each panel.
   c. Check verification of color coding, tagging, numbering, and splice make-up.
   d. Verify that all conductors associated with each circuit are in same conduit.
   e. Demonstrate that all lights, jacks, switches, outlets, and equipment operate satisfactorily and as called for.
   f. Perform megger tests of all new distribution system feeders prior to energizing. All Cables failing megger tests or with evidence of damage shall be removed and replaced in their entirety (no splices), at no cost to the Owner. Damaged cables may not be field repaired without specific approval of the Architect.
5. Fire Alarm System: Verify that all equipment, components, and devices function as specified. Refer to Section 28 3101 for additional testing requirements.
6. Clock/Speaker System: Verify that all equipment, components, and devices function as specified. Refer to Section 27 5100 for additional testing requirements.
7. Lighting Control System: Verify that all equipment, components, and devices function as specified. Refer to Section 26 5101 for additional testing requirements.
8. Telecommunications System: Verify that all equipment, components, and devices function as specified. Refer to Section 27 0000 for additional testing requirements.
9. Where the following systems are specified herein and/or indicated on the drawings, verify that all equipment, components, and devices function as specified and meet all additional testing as described in related individual Sections of this specification:
   a. Medium voltage switchgear, transformers, and distribution system.
   b. Energy Storage system.
   c. Photovoltaic system.
   d. Clock/Speaker system.
   e. Security system.
   f. Assisted Listening System.

B. Title 24 Acceptance Testing: Contractor shall complete the requirements for Title 24 Acceptance Testing, as per CA Title 24, Part 6.
   1. Perform testing requirements as per Title 24 Lighting Acceptance requirements. Testing shall include construction inspection of installed controls, occupancy / motion sensor testing, manual daylighting controls testing, automatic time switch controls testing, and demand response system interface, as applicable.
   2. Complete and submit all required forms for complete Acceptance Testing.
   3. Acceptance tests must be performed or overseen by certified Acceptance Test Technicians.
   4. Obtain required review and approval of Acceptance Forms to allow final certificate of occupancy to be granted.

C. Close-Out Photography:
   1. Photographs and/or video documentation shall be taken before, during, and after project construction. Project areas to be documented shall include, but not limited to the following:
      a. Underground applications to facilitate minimizing damage to underground utilities, etc..
      b. Behind the wall applications to facilitate minimizing damage to piping, cabling, etc..
      c. Above ceiling applications, especially where not visible or limited accessibility.
      d. Other areas for overall assistance with the progress of the various installations that may or may not be recorded or seen before, during, and/or after field-walk.
      e. Photographic documentation shall assist in case of incomplete, incorrect, and/or missing as-built information.
      f. Photographic and video documentation shall be provided as part of the closing/ close-out documentation package to the District.

END OF SECTION

SECTION 26 12 02

THREE-PHASE PADMOUNTED TRANSFORMER

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American National Standards Institute (ANSI) Publications:

C2 National Electric Safety Code

C57.12.26 Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformesrs, Separable Insulated High Voltage Connectors; High Voltage 24,940 GRDY/14400 Volts and below; 2500 kVA and Smaller

Z35.1 Specifications for Accident Prevention Signs

C. American Society for Testing and Materials (ASTM) Publications (Latest Edition):

D 92 Test Method for Flash and Fire Points by Cleveland Open Cup

D 117 Test Method for Electrical Insulating Oils of Petroleum Origin

D 877 Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

D 3487 Mineral Insulating Oil Used in Electrical Apparatus, Standard Specification

D. Institute of Electrical and Electronic Engineers, Inc. (IEEE) Publication (Latest Edition):

386 Separable Insulated Connectors for Power Distribution Systems Above 600 V

E. National Fire Protection Association (NFPA) Publication (Latest Edition):

70 National Electrical Code

F. Nema 210.

1.2 SUBMITTALS

A. Catalog Information and Shop Drawings: Indicate ratings, capacity, and detailed arrangement of components.
   1. Distribution Transformer
   2. Primary Fuses
   3. Primary Oil-Immersed Switches

B. Certificates:
   1. Certified Test Report of Transformer Manufacturer
   2. Provide CBC 2016 compliant seismic installation. See Section 26 05 00 for all certification and submittal requirements.

C. Equipment bushings, dead-end plugs, dead break junctions and grounding connectors shall be submitted to and approved by the Architect before ordering.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Distribution Padmount Compartmental-Type Transformer: The unit shall be suitable for loop connection and shall contain the transformer, six 200A universal bushing wells, three two position rotary oil-immersed load break - load make switches including an A and a B loop switch and a transformer winding switch, primary current limiting fusing, and primary overload fusing in a weather resistant, tamper-resistant enclosure, arranged for padlocking, with a full tank and compartment weather cover. Transformer shall conform to ANSI C57.12.26. High voltage and low voltage compartments shall be isolated from each other in a manner to require a separate unlatching or unbolting action to give access to the high voltage compartment. (Note: provide radial connection where indicated on the drawings).

B. Transformer shall conform to Owner's Standards, including testing and adjustment requirements.

C. Transformer: Dead front, three phase, two winding, 60 Hz, 65 degree C rise, oil insulated, self-cooled type rated as indicated on the drawings, with two 2-1/2% full capacity taps above and below rated primary voltage. Basic Insulation Level shall be 125 kV on the primary side, and 30 kV minimum on the secondary side. High voltage winding shall be 12.47 kV delta (or 12.00 kV where indicated on the drawings). Low voltage shall be 277/480 V grounded wye, 4-wire. Windings shall be copper. Transformer tank shall be sealed except for bolted handhole access. Provide lifting lugs. Provide external tap changing for de-energized operation only. Locate the changer control handle within the high voltage compartment and provide position indicator and method of securing the control handle against unintentional operation. Switch indicating plate shall be readable from 5 feet away. Tank Construction: Liquid immersed transformer shall have a totally bolted gasketed cover with a weather cover over the compartment and over the tank.

D. The transformer tank and compartment shall be assembled as an integral unit for mounting on a pad. There shall be no exposed screws, bolts, or other fastening devices, which are externally removable. There shall be no openings through which foreign objects such as sticks, rods, or wires might contact live parts. The construction shall limit the entry of water (other than flood water) into the compartment so as not to impair the operation of the transformer.

E. Full-height, air-filled high voltage and low voltage terminal compartments with full-height and full-width hinged door for each compartment shall be located side-by-side separated by a steel barrier, with the high voltage compartment on the left (as viewed from the front of the transformer). To facilitate making connections and permit cable pulling, the doors and compartment hood shall be removable. Removable doorsill on compartments shall be provided to permit rolling or skidding of unit into place over conduit studs in foundation.

F. Mineral Oil: ASTM D 3487, Type II tested in accordance with ASTM D 117.

G. Transformer: Provide the accessories listed below:
   1. Bronze drain and sampling valve: 1-inch trade size minimum, with FPT plugged discharge
   2. Filter press connections
   3. Ground pads
   4. Provision for lifting and jacking
   5. Top liquid dial-type thermometer without alarm contacts
   6. Pressure-vacuum gauge
   7. Pressure-relief device
   8. Oil fill connection: Capped, 1.25-inch trade size minimum
   9. Oil level gauge: With normal level at full load rated temperature rise indicated
   10. Oil temperature gauge: Calibrated in degrees C, with full load temperature rise indicated
   11. 4 extra hold down pads compliant with CBC 2016 seismic requirements

H. High-voltage switches: Provide internal, oil-immersed rotary, gang-operated, load break - load make switches. Minimum switch rating shall be load-break and make, 200A continuous; make and latch 10,000A symmetrical; 6,000A minimum for 1 second.

I. Primary Fusing:
   1. Internal Fault Protection: Provide current limiting fusing in dry well, air-insulated, with non-load break fuse holders inserted in the transformer tank. Provide an integral warning notice and safety baffle to prevent fuse removal unless the transformer is de-energized. Fuse values shall be 150 percent of full load current and fuses shall be Class E.
   2. "Weak-link" primary fusing is not acceptable in lieu of current limiting primary fusing.
   3. Overload Protection: Expulsion fuses, dead front Bay-O-Net type.
   4. Provide a spare set of (3) fuses of each type in original cartons.

J. A-B Loop Switches: Provide primary loop switches (both switches normally closed, to maintain loop).

K. Enclosure: Enclosure shall be constructed in accordance with ANSI C57.12.26.

L. Finish - Prior to prime coating, all welds shall be ground smooth. Rust inhibiting prime coat over cleaned and degreased surfaces. Vinyl paint for finish coat on all surfaces. Color shall be Munsell No. 7GY3.29/1.5 Green.

M. Latches - Three Point Vault Style, chromium plated with 4-inch handle and provisions for padlocking.

N. Grounding Pads - Steel ground pad welded to tank wall in primary and secondary compartment. Each pad drilled and tapped for two 3/8 inch (min.) steel bolts.

O. Termination compartment dimensions shall be as follows:
   1. Height: Maximum of 66 inches or the transformer height plus 2 inches (approx.)
   2. Depth: 18 inches minimum, 24 inches maximum.
   3. Width: Primary Compartment 42 inches min.; Secondary Compartment 24 inches min.

P. The nameplate shall comply with ANSI C57.12.26 except that the number of gallons of coolant shall be shown.

Q. Transformer shall be as manufactured by Eaton-Cutler Hammer, Schneider-Square D, ABB, Cooper, or approved equal.

R. High Voltage Separable Connectors: Provide well bushings with 15 kV inserts for separable connector terminations - see Section 26 05 13 for connector requirements.

S. Secondary Connections - Spade bushings: National Electrical Manufacturers Association (NEMA) drilled copper terminal, 1.75 inch hole spacing. Provide secondary bus supports using an insulating material to prevent spade from bending due to cable weight. Hi-press lugs only for cable termination.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Padmounted transformer installation shall conform to the Manufacturer's shop drawings and mounting instructions and shall include securing it to a concrete pad by at least four anchor bolts. Completed installation shall conform to the requirements of ANSI C2.

3.2 FIELD TESTS

A. Testing of medium voltage equipment shall be performed in conjunction with the Manufacturer's representative.

B. Coordinate with the factory representative and provide all assistance required in the start-up and testing of the equipment.

C. Perform inspection and tests per NETA ATS-2017 Section “Transformers - Liquid-Filled". Laboratory tests on the insulating fluid for the following items are not required: Specific gravity, power factor, water content, dissolved gas analysis, total

combustible gas content. The following tests are not required; winding-resistance tests on each winding in final tap position, percent oxygen tests on the nitrogen gas blanket.

D. Field testing requirements for transformer to include ASTM D877 dielectric liquid test, ASTM D971 interfacial tension test and ASTM D1533 moisture content test.

E. See Section 26 08 00, "TESTING", for additional requirements.

END OF SECTION

SECTION 26 24 00

SERVICE AND DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included in This Section: All materials, labor, equipment, services and incidentals necessary to install the electrical work as shown on the drawings and as specified hereinafter, including but not limited to the work listed below.

B. Underground service distribution conduits and cables where noted for power and telecommunications services, including utility company coordination.

C. Temporary power for construction.

D. Concrete pad and ground rods for 12kV padmounted transformer.

E. Main switchboard, Motor Control Centers, Distribution Switchboards, Distribution Panels, Transformers, Distribution System, Panel Boards, Grounding, and Overcurrent Protective Devices.

F. All required incidental work, such as excavating, backfilling, testing, and temporary power.

G. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

H. All work shall comply with Sections 26 05 00 and 26 27 00.

1.2 RELATED WORK

A. Division 09 - Finishes

B. Division 23 - Heating, Ventilating, and Air Conditioning

1.3 SUBMITTALS

A. Comply with the provisions of Section 26 05 00 - Submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Refer to Section 26 05 00, Part 2 - Products

B. All new equipment shall match existing.

C. List of Equipment Manufacturers:

D. Switchboards and Motor Control Centers
   1. Eaton-Cutler Hammer, General Electric, Industrial Electric Manufacturing, Schneider-Square D.

E. Panelboards and Distribution Panel
   1. Same manufacturer as Main Switchboard.

F. Dry-type Transformers
   1. Eaton-Cutler Hammer, Schneider-Square D, General Electric.

2.2 MATERIALS

A. Provide and install conduits for primary cables by utility company, concrete pad and grounding for utility company transformer, and conduit for secondary service to main switchboard. Comply with all Utility Co. requirements.

B. Furnish and install telecommunications service conduits and pullboxes; install conduits to main point-of-entry backboard as indicated on the drawings. All work shall conform to utility company requirements and to Section 26 27 00.

C. Grounding:
   1. Provide and install grounding system as noted on the drawings.
   2. Grounding electrode conductor: bare stranded copper type, #4/0 minimum.
   3. Install ground wires in rigid conduit.
   4. All grounding electrode conductor connections "thermite" or "cad-weld" welded.
   5. Use approved pressure type solderless connector or use fusion welding for all connections to and bonding of grounding electrode system. All connections shall be visible, readily accessible for testing purposes. Grounding electrode conductor between the grounding electrode and service equipment: Minimum #4/0.
   6. Furnish and install solid copper or copper-clad 5/8" x 10'-0" ground rod(s). Where multiple ground rods are shown, install a minimum of 20'-0" apart. Install ground rods in accessible boxes with covers. Furnish and install 2-#4/0 bare copper cables between multiple ground rods and main switchboard ground bus.
   7. Terminate grounding conduits at equipment with ground bushing, with ground wire connected through bushing.
   8. Provide No. 12 stranded (green) THHN conductor from outlet box to ground screw of every receptacle.
   9. Ground all isolated sections of metallic raceways.
   10. Provide #12 minimum stranded (green) THHN conductor sized per NEC, or as noted, connected continuously throughout branch circuit for all circuits, bonded to panel ground bus, and to all electrical devices and equipment enclosures.
   11. Grounding electrode installed as follows:
      a. Place #4/0 bare copper cable in foundation trench; tensioned, supported in such a manner that it cannot be less than two (2) inches from bottom or side of concrete when foundation concrete is poured; not less than one hundred feet of conductor. Embed in foundation with a loop at approximate center, brought out at top of foundation at location of building service equipment for

connection to service equipment and for bonding to other parts of the grounding electrode system.

b. Use approved pressure type solderless connector or use fusion welding for all connections to grounding electrode. Connection visible, readily accessible for testing purposes. Grounding electrode conductor between the grounding electrode and service equipment: Minimum #4/0.
c. Connect grounding electrode system to metallic water service entry metallic cold water pipe (if available) with nonferrous clamp and bare copper cable (sized as required) in conduit. Connection shall be accessible for inspection.
d. Connect grounding electrode system to effectively grounded building steel as indicated on the drawings. Use exothermic weld, connection shall be accessible for inspection.
e. After installation, test system using the three-point fall of potential method only. Record results and submit to Architect for approval. If resistance to ground exceeds three ohms, install an additional ground rod, bonded and interconnected to the grounding electrode system.
f. Connect ground bar of separately derived systems (e.g all dry-type transformers) to effectively grounded building steel at the closest possible accessible location, or if building is concrete, or the steel is not effectively grounded, to the main switchboard ground bus: Use #4/0 copper conductor for all connections.

D. Main Switchboard, Distribution Switchboards, and Distribution Panels:
1. General: Switchboard shall be group-mounted type, metal enclosure with ground bus and insulated full capacity neutral bus.
2. Equipment:
a. The switchboard shall be braced for a short circuit current of 65,000 amps minimum, and for 100,000 amps when indicated on the drawings. Bracing shall be per NEMA and UL standards.
b. The switchboard shall comply with all the requirements of the Utility Company.
3. The switchboard shall be pad-mounted, self- supporting, dead-front and rear, front-operated, front-connected, distribution type. Nema 1 (indoor) or Nema 3R (outdoor). The enclosure shall be 90 inches high, made of cold rolled steel on a structural shape, or formed, steel frame and shall be mounted on two 3-inch, 5-pound continuous channel iron sills, which shall be closed at the ends between the two channels.
4. This contractor is responsible for the complete installation of the switchboard within the space provided (both vertical and horizontal) and shall verify and/or coordinate all dimensions prior to ordering equipment. Proper allowances should be included to allow complete installation and erection.
5. The switchboard shall be a minimum of 24 inches deep and shall be constructed of National Electrical Code (NEC) gauge steel.
6. For all switchboards or distribution panels rated 1,200 Amps or higher, provide an arc energy reduction measure in compliance with NEC 240.87(B), to reduce arc clearing time.
7. The switchboard shall be provided with a cable pull section at the top of the switchboard. Provide a minimum 12 inches of vertical clearance between the cable terminal lugs bolted to the switchboard busses and the top and bottom of

the switchboard enclosure. Horizontal pull sections and gutters shall be kept free and clear of busses. Where busses cross vertical pull sections, the busses shall be insulated.

8. All connections between bus bars shall be of a bolted type using Belleville washers. Clamps will not be accepted. All bus bars shall be accurately formed, and all holes shall be made in a manner which will permit bus bars and connections to be fitted into place without being forced.
9. The design of all current-carrying devices or parts of the switchboard shall conform to the standard specified in the related sections of Underwriters' Laboratories, Inc. (UL) No. UL-891 and National Electric Manufacturer's Association (NEMA) Standard PB-2, except as these characteristics may be modified herein.
10. Bus bars, connection bars and wiring on the back of the switchboard shall be arranged so that maximum accessibility is provided for cable connections from the front.
11. Ampere ratings for rectangular bus bars shall be in accordance with the temperature rise standard of National Electric Manufacturer's Association (NEMA) and the Underwriters' Laboratories, Inc. (UL).
12. The enclosure shall be chemically cleaned by parkerizing, bonderizing or phoshorizing as a unit after all welding has been completed. The enclosure shall then be painted with a rust- resisting primer coat of paint and shall be finished with a coat of light gray, baked enamel.
13. Each section shall be bussed for the full connected load of that section. Extend bussing to spare circuit breaker "Spaces." Drill busses for future circuit breakers, and provide breaker connector hardware where indicated on the drawings or where required for ready installation of future circuit breakers.
14. Provide copper bus bars and connections with silver-plated contact surfaces.
15. The contact surfaces and studs of all devices to which bus connections are made shall also have silver-plated surfaces.
16. Provide a 200% rated neutral bus for switchboards supplied with 200% rated feeders (incoming or outgoing). Refer to single line riser diagram for feeder ratings.
17. Locate ground bus, with a cross-section equal to at least 25 percent of the capacity of the main bus rating, in the back of the switchboard and extend bus throughout the length of the switchboard assembly. Ground each housing of the assembly directly to this bus.
18. Rigidly support all bus and connection bars and current transformers.
19. Fit all nuts and connections with locking devices to prevent loosening.
20. Provide load connections with solderless lugs. Factory-install all devices shown on Drawings as specified herein.
21. Properly identify the “high leg” of 4-wire delta connected systems as required by NEC 110.15 and 230-56.
22. Provide ground fault protection for all main breakers or feeder breakers rated at 1000A or higher at 277/480V 3PH, and when otherwise indicated on the single line diagram or where otherwise noted on the drawings. Protection shall consist of a current sensor, relaying device, and the appropriately sized overcurrent protection device.
23. Provide a bonding strap from the equipment ground bus to the neutral bus.

24. Provide transient voltage surge protection, integral to or adjacent to the switchboard when indicated on the plans or where otherwise noted in the specifications herein. Refer to Section 26 43 00.
25. Distribution Panels shall comply with all relevant requirements of the above paragraphs - minimum 12" deep, for floor or wall-mounting.
26. The main switchboard or distribution panel shall include space for future electric vehicle charging station connection circuit breaker(s), with a label to identify the space(s) as "EV Capable", per California Green Building Standards Code.

E. Panelboards:
1. Surface (or flush where indicated on the drawings) mounted, with branch circuits as indicated on the drawings.
2. Enclosures: code gauge galvanized sheet steel with welded full flange end pieces, stretcher- leveled steel trim, backpan and door.
3. Bussing of copper with silver-plated contact surfaces.
4. Provide a 200% rated neutral bus for panels supplied with 200% rated feeders (incoming or outgoing). Refer to single line riser diagram for feeder ratings.
5. Properly identify the “high leg” of 4-wire delta connected systems as required by NEC 384-3(e).
6. Trims on surface-mounted cabinets secured with nickel-plated screws with cup washers, bottom of all trims to have lugs for resting on cabinet flange.
7. Panels shall be 20 inches minimum in width, provided with approved gutter space, barriers and adjustable supports. Doors mounted with concealed hinges provided with combination spring latch and lock. Doors and trims and surface mounted cabinets primed and finished with one coat baked on gray enamel. All visible panel enclosures and covers in finished (occupied) areas shall be painted to match adjacent wall finish.
8. Breakers on same phase to be aligned horizontally. Each panel provided with quantity (5) spare handle locks. Install handle locks on all breakers serving fire alarm equipment.
9. Each branch circuit of panelboards to have a permanently fixed number with one word directory, mounted under celluloid on inside of cabinet door, showing circuit numbers and typewritten description of outlets controlled by breakers. Color code mains and each breaker terminal, same as conductor insulation.
10. Each panel shall be equipped with a copper ground bus.
11. All panels shall be fully bussed to accept future circuit breakers, with breaker hardware provided where indicated on the drawings.
12. Panel board submittals shall include diagrams of the circuit breaker arrangements in the panels. Arrange circuit breakers in panels exactly as shown on the panel schedules in the construction documents - no deviations permitted.

F. Circuit Breakers:
1. General: Circuit breakers shall be molded case rated for 480 or 240 volts, multiple or single pole and amperage rating as shown on the drawings, bolt on, manually operated with "de-ion" arc chutes.
2. For all circuit breakers rated 1,200 Amps or higher, provide an arc energy reduction measure in compliance with NEC 240.87(B), to reduce arc clearing time.

3. Main circuit breaker shall be shall be rated to interrupt the available short circuit current - 65,000 amps RMS unless otherwise indicated on the drawings.
4. Distribution circuit breakers shall be rated for the amps interrupting capacity noted on the drawings or U.L. series rated with the main circuit breaker.
5. Branch circuit breakers shall be rated for the amps interrupting capacity or U.L. series rated with the distribution and main circuit breakers, General Electric type THQB or equal, minimum 10,000 A.I.C for 120/208 volt; type TEY or equal, minimum 14,000 A.I.C for 277/480 volt.
6. Where mechanical equipment is U.L. listed for overcurrent protection with fuses or HACR type circuit breakers, provide fuses where a fused switch is shown. Where the overcurrent protection is a circuit breaker provide HACR, (Heating, Air-Conditioning and Refrigeration) type.
7. Provide switch rated type "SWD" circuit breakers were the circuit breaker is used as a switching device in a panelboard.

G. Dry-Type Transformers:
1. Ventilated type.
2. Dry-type general distribution transformers shall meet the California Title 24 requirements for energy efficiency standards and DOE 10 - CFR, Part 431 (2016) for energy efficient transformers.
3. Transformer shall be 3 phase, 60 Hertz. Primary winding shall be Delta connected and secondary winding shall be Wye connected. The temperature rise at rated voltage and full load shall not exceed 150 degrees C with a 220 degrees C U.L. Component Recognized Insulation System. The windings shall be aluminum or copper.
4. The higher voltage winding shall have quantity (6) 2.5% taps - (2) FCAN and (4) FCBN. Set secondary voltage for 120/208V.
5. Transformer terminals shall be front connected for ease of installation and maintenance.
6. Where the transformers are installed outdoors provide weatherproof drip cover, rodent screen and a weathertight rating of the enclosure.

H. 'K' Type Transformers:
1. The transformers shall be marked with a label stating "Suitable for Non-Sinusoidal Current Load with K Factor of 13 (or higher where indicated on the drawings) per UL Guide Specifications.
2. Transformers shall be 3 phase, 60 Hertz. Primary winding shall be Delta connected and secondary winding shall be Wye connected. The temperature rise at rated voltage and full load shall not exceed 150 degrees C with a 220 degrees C U.L. Component Recognized Insulation System. The windings shall be aluminum or copper.
3. The higher voltage winding shall have quantity (6) 2.5% taps - (2) FCAN and (4) FCBN. Set secondary voltage for 120/208V.
4. A copper electrostatic shield shall be inserted between the primary and secondary windings. The primary and secondary conductors shall all be individually insulated, as small in size as possible, and transposed where necessary to keep eddy current losses at an absolute minimum. The primary winding conductor shall be of sufficient size to limit the temperature rise to its rated value even with the circulating 3rd harmonic current. The secondary neutral shall be twice the

ampacity of the secondary phase conductors. The Basic Impulse Level of all windings shall be 10 KV. The core flux density shall be well below the saturation point to prevent core saturation caused by the harmonics even with a 10% primary overvoltage.

5. Transformer terminals shall be front connected for ease of installation and maintenance.
6. Transformers shall meet DOE 10 - CFR, Part 431 (2016) for energy efficient transformers.

I. Magnetic starters: shall be rated in accordance with latest published NEMA standards for size and horsepower rating, Eaton-Cutler Hammer A-200 series or equal. Provide with overload sensor in each phase, hand-off-auto switch, red "run" pilotlight, in NEMA 1, NEMA 4X, or NEMA 3R enclosure or in motor control center where indicated. Coil shall be rated 120 VAC. Starters shall be across-the-line nonreversing unless otherwise noted.

1. Contacts: Across-the-line magnetic starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter must have straight-through wiring.
2. Coils: Coils shall be of molded construction. All coils shall be replaceable from the front without removing the starter from the panel.
3. Overload Relays and Thermal Units: Overload relays shall be the melting alloy type with a replaceable control circuit module. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed.

2.3 ARC FLASH EVALUATION STUDY:

A. An arc flash evaluation study shall be performed to determine, in coordination with the Owner’s safety policy, the required personal protective equipment (PPE) when working on energized equipment.

B. The arc flash evaluation study shall comply with all NFPA 70E and OSHA requirements for calculating and identifying incident energy levels and the corresponding PPE that would be required in each instance.

C. The calculated incident energy levels and recommended PPE for each location shall be summarized in a tabulated form listing location, circuit identification, and PPE. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Architect's attention.

D. Arc flash calculations shall be based on values of fault current magnitudes identified in the short-circuit analysis and the associated clearing times of the over current protective devices determined by the coordination study. The settings recommended by the coordination study shall be the basis of arc flash calculations.

E. Calculation methods shall comply with IEEE Standard 1584 “IEEE Guide for Performing Arc-Flash Hazard Calculations”.

F. Per IEEE Standard 1584, a maximum arc time of two seconds shall be utilized to limit incident energy values.

G. Recommended settings of all protective equipment based on the short circuit and equipment coordination study shall be implemented prior to attaching arc flash hazard labels to the equipment.

H. All electrical equipment shall be field marked to indicate where a flash hazard exists in compliance with NEC 110-116. Labels shall be submitted for approval prior to application. Labels shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

I. Arc Flash Study Report:
   1. The results of the arc flash study shall be summarized in a final report. Five (5) bound copies of the final report shall be submitted to the Architect.
   2. The report shall include the following sections:
      a. Description, purpose, basis, written scope, and a single-line diagram of the portion of the power system which is included within the scope of study.
      b. Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated ar flash energy levels, and commentary regarding same.
      c. Tabulation of appropriate tap settings for relay seal-in units.
      d. Tabulation of arc flash study incident energy levels and PPE requirements.

2.4 SHORT-CIRCUIT ANALYSIS, PROTECTIVE DEVICE EVALUATION, AND COORDINATION STUDY

A. Scope of Services: Provide a current and complete short-circuit study, equipment interrupting or withstand evaluation, and protective device coordination study for the electrical distribution system..
   1. Study shall include all portions of electrical distribution system. Normal and emergency system connections and those which result in maximum fault conditions shall be adequately covered in the study.
   2. The study shall be performed by Emerson Network Power, or equal. Study shall be prepared and signed by a California registered Electrical Engineer.
   3. In the case of additions or modifications to existing distribution systems, the scope of the Study shall include all new portions of the distribution system, and all existing devices upstream of the distribution system modifications all the way to the facility main service switchboard.

B. Submittals:
   1. Submit Study to Architect for review prior to receiving final acceptance of distribution equipment shop drawings or prior to release of equipment for manufacture. If formal completion of Study may cause delay in equipment manufacture, acceptance from Architect may be obtained for preliminary submittal of sufficient study data to ensure that selection of device ratings and characteristics will be satisfactory.

C. Short-Circuit Study:
   1. The study shall be in accordance with applicable ANSI and IEEE Standards.
   2. The study input data shall include the utility company’s primary short-circuit single-and three-phase contribution, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator

contributions, base quantities selected, and all other applicable circuit parameters.

3. Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, distribution switchboard, panelboard, and other significant locations through the system.

D. Equipment Evaluation Study:
   1. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the available fault currents. Any problem areas or inadequacies in the equipment shall be promptly brought to the Architect's attention.

E. Protective Device Coordination Study:
   1. A protective device coordination study shall be performed to select or to check the selections of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker and fuse trip characteristics and settings.
   2. The coordination study shall include all voltage classes of equipment and protective devices. The phase and ground overcurrent protection shall be included, as well as settings for all other adjustable protective devices.
   3. The time-current characteristics of the specified protective devices shall be plotted on appropriate log-log paper. The plots shall include complete titles, representative one-line diagram and legends, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low-voltage circuit breaker trip curves, relay curves and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current National Electrical Code shall be adhered to. Reasonable coordination intervals and separation of characteristics curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate the coordination achieved to each main breaker or fused device, each feeder breaker, and each primary protective device.
   4. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Architect’s attention.

F. Study Report:
   1. The results of the power system study shall be summarized in a final report. Five (5) bound copies of the final report shall be submitted to the Architect.
   2. The report shall include the following sections:
      a. Description, purpose, basis, written scope, and a single-line diagram of the portion of the power system which is included within the scope of study.

b. Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties, and commentary regarding same.
c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
d. Fault current tabulations including a definition of terms and a guide for interpretation.
e. Tabulation of appropriate tap settings for relay seal-in units.
f. Tabulation of arc flash study incident energy levels and PPE requirements.

PART 3 - EXECUTION

3.1 REFER TO SECTION 26 05 00 FOR DETAILS OF WORK UNDER THIS SECTION.

3.2 INSTALLATION/APPLICATION/ERECTION

A. Electric Service: Contact the local electric utility company service planning representative and coordinate with and arrange with the utility company for electric service to the project, including finalization of service application as required. Furnish and install all materials and labor necessary for complete installation as noted on drawings. Submit shop drawings and obtain approval from the utility company prior to fabrication. Also provide and install temporary power as required for construction operations.

B. Telecommunications Service: Contact the local telecommunications and broadband utility company service planning representative and coordinate with and arrange with the utility company for telecommunications service to the project, including finalization of service application as required. Furnish and install all materials and labor necessary for complete installation as noted on the drawings and as required by the utility company.

C. Excavate and trench as necessary for the electrical installation, and when the work has been installed, inspected and approved, backfill all excavations with clean earth from excavation, or imported sandy soil in maximum 8" (eight-inch) layers, moisten and machine tamp to 95% compaction, and restore the ground and/or paving or floor surfaces to their original condition.

D. Switchboards and Distribution Panels Installation: Mount as detailed on the drawings.

E. Motor Connections:
1. Install motor circuits complete for all motors by other trades
2. Furnish and install all disconnect switches, outlet boxes, etc., as required by code.
3. All motor and temperature control low voltage wiring shall be installed and connected by Division 23 Section of specifications, unless otherwise indicated on electrical drawings.

F. Motor Starters Installation:
1. Deliver starters to site without thermal overload elements. Determine nameplate rating of each motor, after motor and starter installation, select thermal element

rating from measured motor running current and install proper elements in starters.

a. Submit chart denoting motor designation, motor H.P., motor running current (N.P.), actual running current fuse/breaker size and thermal element catalog number. Take readings of motor running currents in conjunction with Division 23 - Heating, Ventilating, and Air Conditioning.

3.3 TESTS

A. Testing and Inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 27 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to install the electrical work as shown on the drawings and as specified hereinafter, including but not limited to the work listed below:
   1. Raceways, feeders, branch circuit wiring, wiring devices, safety switches and connections to all equipment requiring electric service.

B. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

C. All work shall comply with Section 26 05 00.

1.2 RELATED WORK

A. Division 09 - Finishes

B. Division 23 - Motors and Mechanical Equipment Installation

1.3 SUBMITTALS

A. Comply with the provisions of Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Refer to Section 26 05 00, Basic Electrical Requirements, Part 2 - Products.

B. List of Equipment Manufacturers:

C. Conduit and Conduit Fittings
   1. Allied Tube and Conduit, Wester Tube and Conduit, LTV Steel Tubular, National Electric Products, AFC, Republic Steel Corporation, Rome Cable Corporation, United States Steel Corporation, Killark Electric Manufacting Company, Raco, VAW Aluminum Company, Bridgeport, Steel City, Thomas & Betts, Carlon, O.Z. Gedney, Appleton, Regal.

D. Wire and Cable (600V)
   1. American Wire Company, General Wire and Cable Corporation, Okonite Company, Rome Cable Corporation, Cerrowire, American Insulated Wire, AFC Cable Systems, Essex, Simplex Wire and Cable Company, Southwire.

E. Solderless Lugs and Grounding Connections

1. Burndy Engineering Company Inc, O.Z. Gedney Company Inc, Penn Union Electric Corporation, Thomas and Betts Company Inc.

F. Pull Boxes, Gutters, Special Cabinets
   1. Schneider-Square D Company, Columbia Electric Manufacturing Company, General Electric Company, Eaton Inc.

G. Outlet Boxes
   1. Appleton Electric Company, Killark Electric Manufacturing Company, Lew Electric Fittings Company, National Electric Products Corporation, Raco, Steel City Electric Company, Carlon, Bowers.

H. Floor Boxes
   1. Steel City Electric Company, Hubbell Inc, RCI, Walker.

I. Wiring Devices
   1. Leviton, Arrow-Hart, Cooper, Hubbell, Lutron, Bryant.

J. Conduit Racks, Hangers
   1. General Electric Company, Killark Electric Manufacturing Company, Caddy, National Electric Products Corporation, Republic Steel Corporation, Rome Cable Corporation, United States Steel Corporation, VAW Aluminum Company, Superstrut, B-Line.

K. Safety Switches (Disconnect and Fusible)
   1. Schneider-Square D Company, Eaton-Cutler Hammer Inc, General Electric Company.

L. Fuses
   1. Bussman Manufacturing Company, Chase-Shawmut Company.

M. Firestopping
   1. 3M, Nelson.

2.2 MATERIALS

A. Raceways: Only the raceways specified below shall be utilized on this project. Substitutions shall be pre-approved in writing. All bare conduit ends (stub-ups or stub-outs) shall be provided with bushed ends or manufactured insulated throat connectors:
   1. Rigid Type - hot dip galvanized or sherardized steel, use on all exterior locations, below grade or in concrete slab, and to 18" on either side of structural expansion joints in floor slabs, with completely watertight, threaded fittings throughout. Compression fittings are not acceptable.
      a. All rigid steel conduit couplings and elbows in soil or concrete or under membrane to be ½ lap wrapped with Scotch #50 tape and threaded ends coated with T&B #S.C.40 rust inhibitor prior to installation of couplings.
      b. ½ lap wrap all rigid steel conduit stub-ups from slab or grade to 6" above finished grade level with Scotch #50 tape.
   2. In lieu of rigid steel conduit for power and control raceways and branch circuit conduits in soil or concrete slabs, "Schedule 40" PVC with Schedule 80 PVC

conduit elbows and stub-ups may be used with code size (minimum No. 12) ground wire. A “stub-up” is considered to terminate 6" above the finished surface.

a. Schedule 80 PVC conduit shall be used in all concrete footings or foundations and to 18" of either side of footings or foundation walls.
b. Schedule 80 PVC conduit shall be used in all concrete masonry unit (CMU) walls or columns.
c. All conduit runs in concrete floor slabs (where allowed) shall be installed to comply with all applicable CBC and structural codes to maintain the structural integrity of the floor slab. Where conflicts occur, alternate routing shall be provided at no additional cost to the Owner.
d. Where schedule 80 PVC is coupled to schedule 40 or other raceways with differing interior dimensions, each end shall be reamed with a reaming tool to reduce the edge profile for protection of the passing conductors during the pull.

3. Intermediate metal conduit may be used in all exposed interior locations, except that electrical metallic tubing may be used in some locations as noted below. Utilize steel compression type fittings for all exposed conduit runs, unless otherwise noted. Die-cast zinc fittings are unacceptable.
4. Electrical metallic tubing shall be used exposed in interior electrical and mechanical rooms, in interior unfinished spaces, and in interior concealed and furred spaces, made up with steel watertight or steel set screw type fittings and couplings. EMT shall not be used in under-building crawl spaces or other areas subject to moisture. Set screws shall have hardened points. Die-cast zinc fittings are unacceptable.
5. Use flexible conduit for all motor, transformer and recessed fixture connections, minimum ½"; "Seal tite" type used outdoors and in all wet locations, provide with code size (minimum No. 12) bare ground wire in all flexible conduit.
6. All conduit cuts (factory or field cut) shall be perfectly square to the length of the conduit and cut ends shall be reamed with a reaming tool to provide a smooth edge to the passing conductors and to remove all burs and scrapes. Use of a hand file is not acceptable.
7. All electrical raceways shall be installed concealed, unless otherwise noted. Cut and patch to facilitate such installation to match adjacent and original finish. All exposed conduits, where required, shall be installed parallel to building members.
8. All emergency source circuits shall be installed in separate raceways (from normal power), per 2017 NEC 700.10(B), or the applicable code at the time of permitting.
9. Where existing conditions preclude the installation of EMT in existing walls to remain, provide and install cut-in type boxes and "fish" flexible MC or flex conduit and wire through existing walls to remain, unless shown otherwise on plans.
10. Fasten conduits securely to boxes with locknuts and bushings to provide good electrical continuity.
11. Provide chrome escutcheon plates at all exposed wall, ceiling and floor conduit penetrations.
12. Support individual suspended conduits with heavy malleable strap or rod hangers; supports for ½ inch or 3/4 inch conduit placed on maximum 7-foot centers; maximum 10-foot centers on conduits 1 inch or larger.

13. Support multiple conduit runs from Kindorf B907 channels with C-105 and C-106 straps.
14. Conduit bends - long radius.
15. Flash conduits through roof, using approved roof jack; coordinate with General Contractor.
16. To facilitate pulling of feeder conductors, install junction boxes as shown or required.
17. All empty conduits on the project shall be provided with a nylon pull rope to allow pulling of future conductors intended for the specific raceway. Provide plastic wire-tie style nameplate tags on each end of pull rope with printed identification of conduit use and the location of the opposite end of the rope. Pull ropes for telecommunications service conduits shall meet the utility company requirements.
18. Where conduits pass through structural expansion joints in floor slab, rigid galvanized conduit shall be used 18" on either side of joint, complete with Appleton expansion couplings and bonding jumpers, or equal. All above grade expansion joint crossings shall also utilize expansion joint couplings or flex conduit transitions as required for each particular installation. Installed condition shall allow for a minimum deflection of raceway and wire (in any direction) equal to the structural expansion joint dimension (building to building). No solid conduits shall be allowed to cross expansion joints without proper provisions for building and seismic movement.
19. Minimum cover of conduits in ground outside of building - 36 inches, unless otherwise noted.
20. Provide and install exterior wall conduit seals and cable seals in the locations listed below. Coordinate installation and scheduling with other trades:
    a. Conduit seals through exterior wall or slab (below grade): O.Z. Gedney series “FSK" in new cast in concrete locations, series "CSM" in cored locations.
    b. Conduit seals through exterior wall or slab (above grade): O.Z. Gedney series "CSMI."
    c. Cable seals at first interior conduit termination after entry through exterior wall or slab: O.Z. Gedney series "CSBI." Coordinate quantity of conductors at each location.

B. Outlet Boxes and Junction Boxes. Verify all backbox requirements with devices to be installed prior to rough-in.
    1. One piece steel knockout type drawn boxes, unless otherwise noted, sized as required for conditions at each outlet or as noted.
    2. Flush-mounted boxes equipped with galvanized steel raised covers for device mounting flush with finished surface. Provide extension rings as required on all acoustical or additional wall treatment areas to bring top of cover flush with finished surface (coordinate with architectural drawings). Devices shall be capable of being tightly mounted to boxes without distorting or bending device or mounting hardware.
    3. Boxes for fixture outlets: 4-inch octagon or larger as required, or as noted.
    4. Switch and receptacle outlets - not smaller than 4-inch-square in furred walls, with raised cover for single device; ganged where required.

5. Outlet and switch boxes for wet locations, cast aluminum FS or FD type with cast aluminum gasketed spring lid cover. Weatherproof “Bell” type boxes are not acceptable.
6. All connectors from conduit to junction or outlet boxes shall have insulated throats. Connectors shall be manufactured with insulated throats as integral part. Insertable insulated throats are unacceptable.
7. Outlet boxes for telecommunications, 4" square or larger as required or noted, multi-ganged for voice, data, and other services where indicated on the drawings.
8. Conduit Bodies: Malleable iron type, with lubricated spring steel clips over edge of conduit body, O-Z/Gedney type EW, or equal.
9. Pull boxes: All site pull boxes shall be flush in-ground concrete, with engraved covers identifying service use (i.e. electrical, communications, etc.). Boxes shall be Nema 250, Type 6, outside flanged, with recessed cover for flush mounting, by Christy or equal, with required depth to provide box and conduit depths shown or required.
    a. Provide concrete covers for all boxes in planted or paved areas (up to available concrete cover size).
    b. Provide galvanized steel covers for all larger boxes (when concrete is not available), or in traffic areas. No cast iron covers.
    c. Provide bolted covers and slab bottoms (with grouted perimeter) or vault type boxes for all electrical distribution and signal system pull boxes used for site distribution, to prevent rodent entry. No collar type boxes with dirt or gravel bottoms
    d. Provide drain hole at bottom of all vault type boxes, with loose aggregate base below, for proper drainage.
    e. All covers to be completely flush with finished adjacent surfaces.
    f. Provide galvanized steel H20 rated covers and installation of box rated for H20 in all traffic areas.
    g. Provide pullboxes per utility company specifications for all electrical primary and secondary services and for telecommunications service runs. Verify exact size and type prior to order with each utility company.

C. Wire and Cable (line voltage and signal systems):
1. 600-volt class where used for or run with line voltage power wiring, insulation color coded, minimum No. 12 AWG for power branch circuits, No. 14 for power control circuits, and wiring size and type as directed by signal system manufacturer for each signal system.
2. All conductors shall be copper.
3. Size and insulation type:
    a. Standard locations: #12 to #1 AWG: THWN for wet locations and THHN for dry locations. #1/0 through #4/0 AWG: XHHW (55 Mils). 250MCM and larger: XHHW (65 Mils). All wire sizes used shall be based on a 75 degree insulation rating, unless specifically used with 90 degree rated breakers and devices.
    b. All wiring (power and signal) installed underground between buildings, or in wet or damp locations, shall be outside listed and rated for wet locations.
    c. High temperature and non-standard locations: Provide wire type and insulation category suitable for area of use as defined in NEC table 310-13.

4. Conductors No. 8 and larger and as otherwise noted on drawings shall be stranded. Power conductors No. 12 and No. 10 shall be solid or stranded. Power conductors No. 14 or smaller shall be solid.
5. Provide signal system wiring for each system to meet the system manufacturers requirements and recommendations for each device or equipment type. Signal wiring systems shall be provided with shielding and/or insulation type and cable quantities as directed by the manufacturer, and meet all NEC requirements for locations used.
6. Install all wiring branch circuits and feeders (low voltage and line voltage) in conduit unless noted otherwise on the drawings. Contractor shall mandrel all feeders and pass a "sock" (or utilize other suitable means) through each raceway prior to pull to remove all water and construction debris. All raceways shall be completely clear of any obstructions or debris and all cut ends shall be reamed, prior to pull. Utilize pulling compound on all runs to insure minimum friction and pulling tension.
7. Megger test all feeders prior to energizing. See section 26 08 00 for additional information.
8. Approximately balance branch circuits about the neutral conductors in panels.
9. Connections to devices from "thru-feed" branch circuit conductors to be made with pigtails, with no interruption of the branch circuit conductors.
10. Neutral conductor identified by white outer braid, with different tracers of "EZ" numbering tags used where more than one neutral conductor is contained in a single raceway.
11. Neatly arrange and "marlin" wires in panels and distribution panelboards with "T and B Ty-rap" or approved equal plastic type strapping.
12. All wire and cable shall bear the Underwriters' Label, brought to the job in unbroken packages; wire color-coded as follows:

	Voltage	Phasing	A	B	C	N
b.	120/208	3PH4W	Black	Red	Blue	White
c.	2083PH	3W	Black	Red	Blue	--
d.	277/480	3PH4W	Brown	Orange	Yellow	White
e.	4803PH	3W	Brown	Orange	Yellow	--
f.	120/240	3PH4W	Black	Red	Blue	White
g.	2403PH	3W	Black	Red	Blue	--

13. The equipment grounding conductor shall be insulated copper; where it is insulated, the insulation shall be colored green.
14. Label each wire of each electrical system in each pull box, junction box, outlet box, terminal cabinet, and panelboard in which it appears with "EZ" numbering tags indicating the connected circuit numbers.
15. Properly identify the “high leg” of 4-wire delta connected systems (in each accessible location) as required by NEC 110.15 and 230-56.
16. Provide permanently affixed adhesive labels with machine printed lettering (min. 1/8" high) at junction boxes serving fixtures that are supplied by (2) electrical sources (i.e. normal and emergency lighting). Label to read "CAUTION - This light fixture is powered by (2) separate sources. The normal power source breaker and the emergency power source breaker must be turned off before servicing this light fixture."

17. Install feeder cables in one continuous section unless splices are approved by Architect. Exercise care in pulling to avoid damage or disarrangement of conductors, using approved grips. No cable shall be bent to smaller radius than the spool on which it was delivered from the manufacturer. Color code feeder cables at terminals. Provide identifying linen tags in each pullbox.

D. Switches: Model numbers are Hubbell, color to be selected by architect, unless otherwise noted. All switches to utilize screw terminals for wire connections - no plug-in terminations:
   1. Single Pole - No. HBL1221
   2. Two Pole - No. HBL1222
   3. Three Way - No. HBL1223
   4. Momentary contact - No. HBL1557
   5. Momentary contact Keyed - No. HBL1556L
   6. Keyed, - No. HBL1221L
   7. Pilot Light (on with load on) - Hubbell No. 1221-PLC
   8. Motor Rated Double Pole (30A) - Hubbell No. 7832
   9. Motor Rated Three Pole (30A) - Hubbell No. 7810.
   10. Low voltage Data line switches - Refer to lighting control system (for compatibility)

E. Receptacles: Mounting straps and contacts shall be one piece design, constructed of minimum .050" solid brass. Base shall be high strength, heat resistant, glass reinforced nylon. Device shall accept up to #10 wire, side or back wired with screw terminals - no plug-in terminations. Hubbell, Leviton, Pass & Seymore, or equal. Color to be selected by architect, unless otherwise noted. Numbers listed below are Hubbell:
   1. 15A 3PG 125 volt duplex - No. HBL5262
   2. 20A 3PG 125 volt duplex - No. HBL5362
   3. 20A 3PG 125 volt ground fault interrupter receptacle; GFI receptacles shall conform to the 2006 UL requirements to a) interrupt power to the unit in the event of internal failure, or b) provide an audible or visual indication of internal failure of the GFI; No. GF20 or equal. Through wiring to down stream GFI designated receptacles is not acceptable.
   4. 15A 3PG 125 volt half controlled duplex receptacle - No. BR15C1(color), with permanent "controlled" marking, factory applied.
   5. 20A 3PG 125 volt half controlled duplex receptacle - No. BR20C1(color), with permanent "controlled" marking, factory applied.
   6. 15A 3PG 125 volt full controlled duplex receptacle - No. BR15C2(color), with permanent "controlled" marking, factory applied.
   7. 20A 3PG 125 volt full controlled duplex receptacle - No. BR20C2(color), with permanent "controlled" marking, factory applied.
   8. GFI Module (blank face), no indicator light, 20A - No. GFBF20 or equal.
   9. All receptacles located in exterior or wet locations shall be corrosion resistant with UV stabilized body.
   10. All receptacles in locations identified in NEC 406.12 (i.e. dwelling units, hotel/motel guest rooms, child care, preschool, K-12 schools, business office common areas, clinics, medical, and outpatient facilities, assembly area common areas, dormitory units, and assisted living units) shall be tamper resistant.

F. Plates: Leviton, or equal, except as noted:

1. The color of all faceplates shall match the color of the devices installed under/in the faceplate, except as specifically noted otherwise.
2. For flush outlet boxes, for switches, and receptacles: nylon, color to be selected by architect, unless otherwise noted.
3. Plates for surface-mounted outlets: galvanized steel unless otherwise noted.
4. Weatherproof duplex receptacle plates for exterior locations with ground fault interrupter receptacles in type FS or FD boxes - Hubbell #WPFS26 or compatible equal. Verify cover compatibility with box type and device installed.
5. Weatherproof "in-use" cover, vertical or horizontal mount, for exterior with GFCI receptacles. Die-cast metal alloy, TayMac MX series or equal with openings to match installed devices.
6. Locking plates for duplex receptacles where noted; Pass & Seymour #WP26-L (non- weather proof).
7. Locking plates for duplex exterior GFCI receptacles (or in wet or damp locations); Heavy duty cast aluminum flush cover with locking latch and key, Pass & Seymour #4600 with appropriate mounting plate for type of device installed. Coordinate backbox requirements and finished wall trim-out with wall installer prior to rough-in to insure an adequate and neat trim appearance upon completion.
8. Plates for flush tele/data boxes: white nylon or as otherwise directed - provide and install at each tele/data outlet plate to match duplex power outlet plate, for jack installation under Section 27 00 00. Where the power and tele/data outlet boxes are shared the plate shall be continuous in multi-gang locations. See drawings.

G. Equipment Disconnects: All disconnects shall be located to allow proper code required clearance in each area. Locations shown on drawings are diagrammatic only. The contractor shall coordinate exact locations in the field (with other trades) prior to rough-in to insure proper clearances.
   1. Motor Disconnect Switches and Safety Switches: General Electric Company Heavy Duty Type "THD", cover interlocked with operating handle so that cover cannot be opened with switch in closed position and switch cannot be closed with cover in open position. 240V or 480V rating, single or multi-pole as required or as noted on drawings, in Nema 1 enclosure indoors or Nema 3R enclosure outdoors unless otherwise noted. Provide dual element motor circuit fuses sized as recommended by equipment manufacturer (for final equipment actually installed).
   2. Code required disconnects: Provide a local disconnect in addition to the branch circuit protection device for all equipment as required by code (whether shown or not). Disconnects shall consist of a motor rated switch (or disconnect) for all motor loads less than 3/4HP or other suitable disconnect sized to match branch circuit conductors and load current of equipment, with number of poles as required.

H. Lugs and Connectors: Thomas and Betts "lock-tite", for No. 4 and larger wire; 3M "Scotchlock" fixed spring screw-on type wire connectors with insulator for No. 6 and smaller wire.
   1. All splices shall be made up with screw-on type connectors - no plug-in or push-in style connectors acceptable. Wires shall be solidly twisted together with electricians pliers before screw-on connector is installed to ensure a proper connection in the event of wire nut failure. No exceptions.

2. Connectors listed or labeled for “no wire twisting required” are not an acceptable substitute for actual wire twisting.
3. Utilize porcelain type connectors in all high temperature environments (above 105 degrees Celsius).

I. Splice Insulation: "Scotch" electrical tape with vinyl plastic backing or rubber tape with protective friction tape for interior work.
   1. Splices in electrical cables of 600 volt insulation class in underground system duct shall be made only in accessible locations such as pullboxes, light pole handholes, etc., using a compression connector on the conductor and by insulating and waterproofing (for exterior and underground locations) by one of the following methods:
      a. Cast type splice insulation shall be provided by means of a molded casting process employing a thermosetting epoxy resin insulating material which shall be applied by a gravity poured method or by a pressure injected method. The component materials of the resin insulation shall be in a packaged form ready for convenient mixing after removing from the package. Do not allow the cables to be removed until after the splicing material has completely set.
      b. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for the cables to be applied. When the mold is in place around the joined conductors, the resin mix shall be prepared and poured into the mold. Do not allow cables to be moved until after the splicing materials have completely set.

J. Identification: Refer to Section 26 05 00.

K. Firestopping: as manufactured by 3M Fire Protection Products or equal.
   1. Fire-rated and smoke barrier construction: Maintain barrier and structural floor fire and smoke resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound vibration absorption, an at other construction gaps.
   2. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall penetrations. Systems or devices must be asbestos free.

PART 3 - EXECUTION

3.1 REFER TO BASIC ELECTRICAL REQUIREMENTS - SECTION 26 05 00 FOR WORK UNDER THIS SECTION.

3.2 TESTS

A. Testing and Inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 31 01

PHOTOVOLTAIC SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

1.2 WORK INCLUDED

A. Work included in this Section: All design, materials, labor, equipment, services, and incidentals necessary to install a complete Photovoltaic (PV) System as specified hereinafter, including but not limited to the work listed below.

B. The system shall be utility grid connected with no storage batteries. The contractor shall be responsible for all required utility company coordination, approval, and applications for the complete interconnection of the PV system with the utility company grid, including bi-directional utility meter.

1.3 SCOPE

A. The system shall consist of an array of framed photovoltaic modules, all mounting hardware, terminal boxes and combiner panels, quick-connect electrical connectors, DC wiring, DC disconnects, utility interactive inverters, AC disconnect, isolation transformer, AC feeder, main PV system disconnect, utility company PV system disconnect, and a complete data acquisition and monitoring system to allow the Owner to monitor and utilize the collected data over the Owner network.

B. PV system shall be capable of Rapid Shutdown of PV system circuits on or in buildings per NEC 690.12 (this shall not apply to ground-mounted or carport mounted systems). Methods and designs for achieving proper rapid shutdown shall be addressed and included in the submittals for all projects with PV systems in or on buildings.

C. The work shall include furnishing all labor, materials, and equipment necessary to form a complete installation, ready for operation to produce solar power at the site.

D. The installing contractor shall be responsible for adequate clearance and equipment space within the allotted roof areas and/or shade structure areas and existing interior building area. All equipment and sizes / clearances shall be coordinated with the architect and Owner prior to rough-in.

E. The system installer shall submit for and pay for the required permits and inspections with the local Authority Having Jurisdiction (AHJ) and utility company.

F. The installer shall complete all of the required paper work for the utility interconnection agreement contract in conjunction with the Owner’s input and approval, including rate schedule (i.e. TOU or other) designations. In order for the Installer to act on behalf of the Owner, the installer (in conjunction with the Owner) shall submit to the utility company the proper authorization forms.

G. The installer shall also be responsible for and submit for and pay filing fees, and obtain any relevant buy-down incentive rebates available for the system and properly credit the value to the Owner. This shall include application (and payment) of all required “reservation” applications as well as system applications and system certification and testing with the utility company to receive the final rebates.
   1. The incentives and other credits may be claimed buy the installer / Contractor if properly identified and allotted for in the Bid price and contract (for credit to the Owner).

H. System installation shall include the programming, set-up, and commissioning of a web based data acquisition system and interactive data application to allow public viewing of the real-time system performance and past historical performance.

1.4 WARRANTIES

A. All solar energy equipment for electricity generation (PV modules, inverters, solar collectors, and tracking mechanisms) shall have a minimum 10-year manufacturer warranty, and shall protect against degradation of electrical generation output of more than 15% from their originally rated electrical output.

B. Contractor shall provide a minimum 10-year guarantee to provide for no-cost repair and replacement of the system for any expenses not otherwise covered by the manufacturer.

C. Contractor shall provide a minimum 10-year guarantee to protect the purchaser against more than a 15% degradation of electrical generation output that may occur as a result of faulty installation.

D. Meters must have a one-year warranty to ensure against defective workmanship, system or component breakdown, or degradation in electrical output of more than fifteen percent from their originally rated electrical output during the warranty period. For meters that are integrated into the inverter, the meter warranty period must be 10 years.

E. System installation shall be such that it does not affect the roofs and/or shade structures warranty.

1.5 APPLICABLE GUIDELINES / REGULATIONS / STANDARDS

A. CPUC approved Electric Rule 21 - Generating Facility Interconnections

B. UL1741 (Inverters, Converters, and Controllers for Independent Power Systems)

C. UL1703 (Standard for Flat-Plate Photovoltaic Modules and Panels).

D. IEEE 929 (2000) - Recommended Practice for Utility Interface of Photovoltaic (PV) Systems.

E. IEEE 1262 (1995) - Recommended Practice for Qualifications of Photovoltaic (PV) Modules.

F. NEC Articles 690 and 705.

1.6 QUALITY ASSURANCE

A. Underwriters' Laboratories shall certify the system.

B. Contractor Qualification - The contractor shall be approved by the PV equipment manufacturer(s) to install the PV materials.

1.7 SUBMITTALS

A. Submit the following for approval:
   1. Roof and/or ground mounted and/or shade structure plans with the PV System layout (based on submitted panel).
   2. Single line Diagrams indicating all required connections and utility tie-in.
   3. Array calculations including string design, string amperage, array amperage (including short circuit currents), and DC voltages (maximum and minimum based on coldest record low and average high ambient temperatures).
   4. DC combiner boxes with fusing.
   5. DC/AC Inverter(s).
   6. Isolation Transformer (if applicable).
   7. kWH Meter and Logger.
   8. Data Acquisition System.
   9. PV System weights.
   10. PV Modules.
   11. Installation Manuals.
   12. Operation and Maintenance manuals.
   13. Web based data aquisition system and application software.
   14. Mounting hardware.
   15. Wiring (AC and DC).
   16. Disconnects.
   17. PV Weather Station including solar radiation, environmental temperature and humidity, wind direction, wind speed and module temperatures.
   18. Placards (with all Code and utility required designations).
   19. Testing and certification/commissioning results (upon completion).

1.8 DELIVERY, STORAGE, AND HANDLING

A. All equipment and panels shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.

B. Appropriate protective clothing shall be worn when handling the equipment. Such clothing shall include hard hats and steel-toe boots when lifting materials to roof, and insulated gloves when working on an active system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable system manufacturers/vendors shall have been in the business of producing and/or installing similar commercial grade solar photovoltaic systems for the last 5 years minimum (50 kW systems or higher). Manufacturers shall provide their latest line of equipment, meeting all current industry standards.

B. For basis of design systems, the minimum performance of the system shall match the physical and electrical equipment characteristics as shown on the electrical drawings.

C. Other modules and equipment are acceptable when meeting the minimum system performance listed herein and complying with all other technical aspects of the system as listed herein.

2.2 MATERIALS

A. The PV modules shall have physical and electrical characteristics which match the modules specified on the electrical drawings. Alternate modules, if allowed, shall have similar characteristics.
   1. All PV modules shall be UL 1703 listed.
   2. All PV modules shall be a max system voltage of 600Volt UL, or 1000Volt UL. Inverter and module max system voltages shall be equal.
   3. All PV module cell types shall be ‘monocrystalline’ or ‘polycrystalline’, and shall be similar in cell type to that of the modules specified on the electrical drawings.

B. The Electrical Module characteristics shown on the drawings shall be used as a minimum standard for any design submitted.

C. Each inverter shall be by SMA America, SolarEdge, ABB, or equal, sized as required to support the PV module production load that shall not exceed the manufacturer's rating of the equipment. All inverters shall be CEC approved and shall be utility line interactive type with the following:
   1. Nominal AC Voltage shall match the available utility line voltage
      a. Nominal AC Frequency (+ 0.5 Hz)
         1) 60 Hz
      b. Line Power Factor (Above 20% rated power)
         1) >0.99
   2. Maximum Open Circuit Voltage DC
      a. 600 VDC or 1000VCD
      b. Inverter and PV modules max voltages shall match.
   3. Peak Inverter Efficiency
      a. >96% for DC to AC transformer type inverters
      b. >98% for transformerless type inverters
   4. Enclosure Environmental Rating
      a. NEMA 3R (or NEMA 4X)
   5. Enclosure Environmental Rating
      a. Galvaneal folded steel enclosure
   6. Sound level

a. <65dB(A)
7. Array Configuration
   a. Monopole, negative grounded or floating - Bi-polar, neutral grounded
8. Protective Functions
   a. Standard wakeup voltage, wakeup time delay, shutdown power, shutdown time delay, AC over / under voltage and time delays, AC over / under frequency and time delays, ground over current, over-temperature, AC and DC over current, DC over voltage
   b. Arc-Fault Circuit Protection (Direct Current) per NEC Article 690.11
9. User Display
   a. Standard-LCD with on/off capability
10. AC Disconnect
    a. Load break rated
11. DC Disconnect
    a. 600 VDC or 1000 VDC load break rated
12. Isolation Transformer (where used)
    a. High efficiency mounted within same enclosure
13. Communications Software
14. Serial communications and control software
15. UL 1741 listed.
16. CEC 2016 compliant seismic rating.
17. Internal combiner panel to allow connections of sub-arrays at the Inverter without the use of additional equipment.
18. Provide a placard on the Inverter per section 3.1 below.

D. PV System to electric service equipment interface shall be as follows:
   1. Connected on the supply side of the main service disconnect per 2017 NEC Article 705.
      a. The connection shall be made within physical space and lug connections suitable for the termination and bend radius of the cabling shown on the electrical drawings.
      b. Where existing equipment is intended to be utilized for supply side connections, it shall be the responsibility of the contractor to maintain the UL listing of the equipment with interconnection installed.
   2. Alternatively, if indicated on the drawings, the PV system shall be connected on the load side of the main service disconnect per 2017 NEC Article 705.
      a. The connection shall be made with a bolt-on circuit breaker connection located at the opposite end of the distribution section bussing from where the bussing receives its normal utility service supply. The circuit breaker shall be listed for back-feeding (i.e. it shall not contain designations for line and load side wiring).
      b. The sum of the circuit breakers supplying the bussing shall not exceed 120% of the bussing rating.
      c. The phase connections, including neutral connection (where used), shall be made on the load side of the service ground fault protection (GFP) system and shall not allow any unbalanced currents to pass outside the service ground fault protection system. DO NOT connect to the load side of the GFP system if it is not listed and identified for back-fed installations (allowing currents to pass backwards through the CT's to the utility grid).

1) If a GFP or bussing/breaker conflict exists with the existing equipment, the PV systems shall be connected on the line side of the main service disconnect and GFP systems.
2) Provide a placard on the Main Switchboard to identify the two sources of power feeding the equipment. Also provide a placard identifying the inverter(s) breaker position and its intended purposes and location. Refer to section 3.1 below.

E. Combiner boxes shall be NEMA 4X rated (for corrosive environment) and shall include fuses for string inputs and a bus bar to combine the strings into sub-arrays, for input into the Inverter system. The combiner box shall be provided with a main disconnect switch on the exterior of the housing. Minimum combiner box output bus ampacity shall be 156% of the rated short circuit current available to be carried on the bus (the sum from all strings to the bus).
   1. Provide a placard on the combiner box(es) to read: “DC Combiner Box - 600 VDC Maximum” or “DC Combiner Box - 1000 VDC Maximum” where indicated on the drawings.

F. All AC interconnecting feeders shall be sized to NEC Table 310.15(B)(16) (75 degree column) based on associated disconnect amperage. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and roof conditions per NEC 310.15. Provide equipment grounding conductor in each conduit.

G. All AC circuits to be 3-wire + ground. All grounding per NEC 690, Part V.

H. All DC circuits and feeders sized to NEC table 310.15(B)(16) (90 degree column) based on associated disconnect amperage. Minimum ampacity shall be 156% of the rated short circuit current available to be carried on the specific conductor. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and roof conditions per NEC. Provide equipment grounding conductor in each conduit.

I. All DC circuits to be 2-wire + ground.

J. All AC and DC wiring in conduit to be RHW-2, THWN-2, or XHHW-2 with ratings as follows:
   1. Utilize 90 degree C ampacity, wet rated conductor, for use with 90 degree listed terminals on PV DC equipment.
   2. Utilize 75 degree C ampacity, wet rated conductor, for use with 75 degree listed terminals on AC equipment.

K. All exposed DC wiring to be listed ‘PV WIRE’, USE-2 or SE (90 degree) wet rated and sunlight resistant, 600V or 1000V rated as required.

L. All above ground exposed conduit shall be rigid galvanized steel or aluminum with threaded fittings or painted EMT with water-tight compression fittings. All interior conduit to be EMT with steel set-screw fittings (no cast fittings).

2.3 ARRAY MOUNTING

A. Modules shall be ground-mounted, roof or shade structure mounted, flat to the roof surface, with appropriate racking hardware and structural attachments.

B. Provide structural engineering calculations and/or certifications that the design meets the requirements of the existing building structure and can be adequately supported.

2.4 WIND LOADING

A. The system shall minimize wind loading by mounting the modules flat to the roof or shade structure.

B. Provide structural engineering calculations and/or certifications that the design meets the requirements for wind loading and can be adequately supported and maintained on the roof or shade structure.

2.5 MISC. SYSTEM REQUIREMENTS

A. All exterior equipment to be sunlight and UV resistant as well as rated for elevated temperatures at which they are expected to operate (on roofs in hot sunlight).

B. Heavy duty urethane sealants shall be used for all non-flashed roof penetrations.

C. No dissimilar metals allowed to contact (use plastic or rubber washers)

D. No aluminum in contact with concrete or masonry materials.

E. Use high quality stainless steel fasteners only.

F. Structural members for PV supports should be corrosion resistant aluminum (6061 or 6063), hot dipped galvanized steel (per ASTM A 123), coated or painted steel (in non-corrosive environments only), or stainless steel (in corrosive environments).

G. All PV modules to be installed such that they are 100% free from shade between 8am and 5pm daily.

2.6 SYSTEM ELECTRICAL

A. The modules shall be interconnected using cable assemblies. The pigtails shall be quick-connect electrical wiring connections rated for the application (90 degree rated).

B. The array shall have at least one terminal box, providing a watertight entry to the raceway system leading to the combiner box and Inverter(s).

C. Full specifications of the inverters shall be supplied as part of the system submittal.

D. All major components of the systems and the installation procedures shall meet National Electrical Code requirements, including Article 690.

E. The inverters shall automatically drop-off-line when normal utility power is lost to avoid un-intentional islanding effects. Drop-off to be activated by over-voltage (110%) and under-voltage (88%), and shall be adjustable. Frequency drifts outside 59.3 to 60.5 Hz for more than 10 cycles shall also activate automatic drop-off. Automatic reconnection shall not occur until the normal utility power has been stable for at least 60 seconds.

F. All electrical system equipment shall be properly rated to withstand and interrupt (in the case of over current protection devices) the available fault current at the point of use.

G. The system shall be capable of operating between a power factor of 0.9 lagging to 0.9 leading.

H. All required overcurrent protection and electrical bussing sizes per NEC 690.

I. Provide a grounding electrode connection from the inverter assembly to the nearest building steel per NEC Article 690 and the manufacturer's instructions. Inverters shall have GFCI protection, allowing grounding per NEC Table 250.122.

J. The Main PV System Disconnect (adjacent to the main service panel) shall be clearly labeled and located within 10 feet of the main service meter location per Utility Company requirements.

2.7 MONITORING

A. A Data Acquisition and Monitoring System shall be provided as part of the System. The system shall allow measurement, calculation, and display of the following items (at minimum) via on-site PV Weather Station and Inverter communication (RS 485):
   1. Ambient temperature
   2. Wind speed
   3. Solar irradiation
   4. System electrical functions (instantaneous and accumulated power output (kW and kWH), AC and DC system voltage and amperage, and peak value tracking with associated time stamps).
   5. Pounds of Co2 emissions avoided from the generation of PV energy at the site (compared to conventional coal and gas production methods).

B. Provide a Web based software application to allow interactive display and user requests of system performance, including historical data.

C. Load software on owner provided web page (URL) and train owner in operation and maintenance of software and related monitoring functions.

PART 3 - EXECUTION

3.1 REQUIRED PLACARDS

A. All placards shall be machine generated phenolic type with red background and white lettering, affixed to equipment with stainless steel screws (no adhesives allowed). Minimum lettering size to be 1/4" unless otherwise noted or required for legibility.

B. Provide a placard clearly visible at each main service panel or switchboard to identify both sources of power, with the following wording in 1/4" high lettering per NEC Article 690: "Warning - This Service Is Fed By Two Sources Of Power - The Utility Service Main Disconnect And The PV System Main Disconnect - Both Services Must Be Disconnected To Remove Power From The Panel (Switchboard)".

C. Provide a placard on the PV system input circuit breaker at each main service panel or switchboard with the following wording in 1/4" high lettering per NEC Article 690: "Warning - Inverter Output Connection - Do Not Relocate This Overcurrent Device".

D. Provide a placard on all disconnects with the following wording in 1/4" high lettering per NEC Article 690: "Warning - Electric Shock Hazard - Do Not Touch Terminals - Terminals On Both The Line and Load Sides May Be Energized In The Open Position".

E. Provide a placard on each Main PV System Disconnect (adjacent to each main service panel or switchboard) with the following information in 1/4" high lettering per NEC Article 690: "Photovoltaic Power Source Disconnect - Operating Current: XX Amps; Operating voltage: 480 VAC; Maximum System Voltage: 480 VAC; Short-Circuit Current: XXX Amps", where XX is the maximum AC amperes of the installed system and XXX is the maximum short circuit current that can be delivered through that device - usually the available utility system short circuit current at that location, or, only if noted on the drawings, the maximum short circuit current that the PV system can provide (from all strings in parallel).

F. Provide a placard at each main panel or switchboard with the following information in 1/4" High lettering per NEC Article 690: "Caution - Possible Backfeed From Photovoltaic Power System - 480V, XX Amps", where XX is the maximum AC amperes of the installed system.

G. Provide a placard on each PV System Inverter with the following information in 1/4" high lettering: "Photovoltaic Power Source Inverter Rating - Operating Current: XX Amps; Operating voltage: XXX VDC; Maximum System Voltage: 600 VDC; Short-Circuit Current: XXXX Amps", where XX is the maximum DC amperes of the installed system, XXX is the operating voltage DC, and XXXX is the short circuit current that the Inverter can provide (from all strings in parallel).

H. Provide utility-required system directory placard and utility safety switch identification placard as required by local utility company, to identify all system components.

I. On systems originating from multiple buildings or shade structures where local PV System combiner panels are used to combine the outputs of multiple inverters at the building, the combiner panel shall contain the building main disconnect and the following placards shall be provided:
   1. A placard clearly visible at each building PV System combiner panel to identify both sources of power, with the following wording in 1/4" high lettering per NEC Article 690: “Warning - This Panel has Two Sources Of Power - Utility And The PV System - Both Sources Must Be Disconnected To Remove Power From The Panel”.
   2. At the building disconnect in the combiner panel: “This is one of 2 Building Disconnects. The second Building Disconnect is located in Main Electrical Room XXX”. Verify room number with Architect - Use Owner numbering, not construction room numbering.
   3. At the normal power main breaker at the Main Electrical Room a placard saying “This is one of 2 Building Disconnects. The second Building Disconnect is located in the PV System Room XXX”. Verify room number with Architect - Use Owner numbering, not construction room numbering.

J. In systems originating in multiple buildings or shade structures where a single inverter A. C input breaker at any building also serves as the building main A.C disconnect for that system, provide the following placards:
   1. At the building disconnect in the combiner panel: "This is one of 2 Building Disconnects. The second Building Disconnect is located in Main Electrical Room XXX". Verify room number with Architect - Use Owner numbering, not construction room numbering.
   2. At the normal power main breaker in the main electrical room a placard saying "This is one of 2 Building Disconnects. The second Building Disconnect is located in the PV System Room XXX". Verify room number with Architect - Use Owner numbering, not construction room numbering.

3.2 UTILITY INTERCONNECTION

A. The PV generation system shall not be interconnected with the Utility's distribution facilities until written authorization from the Utility Company has been obtained. Unauthorized interconnections may result in injury to persons and damage to equipment or property for which the installing contractor and Owner may be liable.

3.3 INSTALLATION STANDARDS

A. System Installation shall conform to the equipment manufacturers Installation Manual(s) and requirements or guidelines.

B. All Local, State, and NEC codes shall be observed, including all industry standards related to the installation, operation, and maintenance of photovoltaic power systems.

3.4 TESTING

A. Photovoltaic modules shall be tested in the factory for design performance and results shall be included in the Operation and Maintenance manuals.

B. Inverters shall be factory tested for performance and the results shall be included in the Operation and Maintenance manuals.

C. System testing of the installed photovoltaic array shall be performed on all system strings and recorded in the Operation and Maintenance manuals.

D. Megger test each roof array prior to energizing to establish that no shorts or ground exist at any point on the arrays.

E. Testing to be performed per CPUC Electric Rule 21 testing procedures and requirements. All testing to be done on "no-cloud" days to avoid system fluctuation by passing clouds. Installer to provide all testing and certification / commissioning.

F. System start-up procedure shall be as outlined by the Manufacturer's Installation Manual and the Inverter Manual.

END OF SECTION

SECTION 26 32 01

LITHIUM IRON PHOSPHATE BATTERY STORAGE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall design and build a behind-the-meter Lithium Iron Phosphate, UL9540A, Battery Energy Storage System (BESS), sized as indicated on the single line diagram. Contractor shall provide all labor, material, equipment, engineering, maintenance, and capital to design, install, commission, and interconnect a BESS as required herein.

B. Battery types shall be limited to Lithium Iron Phosphate, no exceptions.

C. Self contained BESS unit shall be UL 9540A listed, having undergone large scale fire testing, no exceptions.

D. Electricity from the BESS must be provided at 60 Hertz and at the appropriate voltage for electrical interconnection to the Site at 277/480V 3PH 4W on the electrical distribution system. The BESS will interconnect at the main switchboard distribution section as shown on the drawings.

E. The BESS, and associated equipment, shall be provided in self-contained National Electrical Manufacturers Association (NEMA) enclosure(s) rated for the site conditions. BESS enclosures will be installed on a concrete pad constructed by Contractor at a location as indicated on the site plan. Contractor shall meet all the seismic requirements for equipment mounting as indicated in Section 260500 of the Specifications. Contractor provided thermal conditioning systems shall maintain ambient temperature within warranty requirements.

F. BESS components and associated ancillary equipment shall have working space clearances required by local code, and electrical circuitry shall be within weatherproof enclosures marked with the environmental rating suitable for the type of environment in compliance with NFPA 70.

G. The Contractor shall commission the BESS and provide a commissioning report documenting BESS performance during normal grid-tied operations and during grid failure.

H. Contractor is responsible for all permits, approvals, environmental compliance, freight, financing, procurement, monitoring, site inspection, billing, and incidentals as necessary to design, construct, and interconnect the complete BESS, described hereinafter.

I. Contractor shall provide and install fire suppression system and observe guidelines from the Californial Electrical Code (CEC) 2022 and the International Association of Firefighters.

J. FEASIBILITY STUDIES AND ENGINEERING STUDIES DONE BY OTHERS

1. The Contractor is responsible for ascertaining relevant site conditions to determine project feasibility and final BESS size, subject to the specified minimum size constraints. If any existing engineering studies or facility conditions reports are provided through this solicitation with the site information package or from Owner representative, the Contractor shall independently verify all information provided.

K. WARRANTIES
1. Contractor shall provide 1 year of turnkey BESS maintenance and warranty service. Contractor shall also provide a warranty from the BESS manufacturer for the full life of the installation for consideration by the Owner.
2. Battery pack performance warranty for at least 10 years after the date of successful completion of commissioning. Battery pack shall retain at least 70% of nominal energy capacity for the earlier of either 10 years after commissioning.
3. Power conversion system warranty of at least 10 years from successful completion of the commissioning.
4. Full turnkey system warranty for 1 year from successful completion of the commissioning. Contractor shall respond within 3 days if maintenance is required.

L. APPLICABLE GUIDELINES / REGULATIONS / STANDARDS
1. All work must follow current National Electrical Code requirements:
   a. NFPA 855, “Standard for the Installation of Stationary Energy Storage Systems”
2. Battery cell:
   a. UL 1642 “Standard for Lithium Batteries”
3. Battery module:
   a. UL 1973 “Batteries for Use in Light Electric Rail Applications and Stationary Applications”
4. Battery system:
   a. UL 9540 “Energy Storage Systems and Equipment”
   b. UL 9540A “Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems”
5. Grid interconnection standards, as applicable to the project as a whole:
   a. Institute of Electrical and Electronics Engineers (IEEE) 1547
   b. UL 1741, “Standard for Static Inverters and Charge, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources”
   c. UL 62109-1 “Safety of power converters for use in photovoltaic power systems – Part 1: General requirements”
6. Other codes and standards that will apply include:
   a. UN 38.3 “Certification for Lithium Batteries” (Transportation)
   b. American National Standards Institute (ANSI) C12.1 (electricity metering)
   c. American Society of Civil Engineers (ASCE)-7 Minimum Design Loads for Buildings and Other Structures
   d. IEEE 2030.2, Guide for the Interoperability of Energy Storage Systems Integrated with the Electric Power Infrastructure

M. QUALITY ASSURANCE
1. Underwriters’ Laboratories shall certify the system.

N. INTERCONNECTION TO ELECTRICAL DISTRIBUTION SYSTEMS
1. It is the sole responsibility of the Contractor to meet the PG&E interconnection requirements. The Contractor shall provide supporting documentation or drawings required by the utility company. Any local codes required by utility interconnection laws and regulations shall be followed by the Contractor.
   a. Owner-Owned Electrical Distribution System Requirements:
      1) Modifications or upgrades to the Owner-owned electrical system required to interconnect the BESS are the responsibility of the Contractor (e.g., service panel, generator coordination). The Contractor is responsible for the proper circuit sizing, overcurrent protection, and coordination of the circuit(s) beyond the point of interconnection to the Owner distribution system, including modifications to the site's electrical equipment and circuits. Any needed upgrades or modifications to the Owner electrical distribution systems must be included in the review and approval process outlined in the submittal section herein.
   b. Serving Utility Electrical Distribution Systems Interconnections:
      1) The Contractor shall provide for interconnection of the behind-the-meter BESS with the Utility-owned electrical distribution system and take actions to ensure that the Owner- and Utility-owned systems are compatible. Modifications or upgrades to the Utility electrical system for interconnection are the responsibility of the Contractor. The Contractor will assume the costs of these modifications. Any modifications to the approved BESS design that would affect the electrical distribution system shall require the written approval of the Owner.
      2) The Contractor is responsible for complying with all electric utility interconnection requirements, including upgrades, providing all necessary BESS details for the interconnection applications, and funding any required interconnection studies to be performed by or on behalf of the electric utility. The Contractor is responsible for gaining approval from the electric utility for interconnection and any electric utility-required upgrades.

O. WORK PLANNING
1. The Contractor shall notify the Owner of any Contractor-planned utility service interruption not later than 21 working days] prior to beginning the scheduled work that requires the utility service interruption. The Owner shall coordinate all utility outages and secure a final date when the outage may proceed. Every reasonable attempt shall be made to secure the Contractor's requested date. Under no conditions shall the utility service be interrupted by Contractor without prior written approval by the Owner.

P. PERMITS AND LICENSING
1. The Contractor shall be responsible for:
   a. Preparing all permitting and licensing applications for the project
   b. Paying all fees and complying with all requirements
   c. Providing any supporting documentation, data, and information that may be required for permitting
   d. Coordinating and acting as the primary liaison with permitting and licensing agencies

Q. LOCAL FIRE MARSHALL INVOLVEMENT
1. The Contractor shall involve the fire marshal or organization responsible for fire protection to provide design advice and design approval. The Contractor shall review the design of the system with the fire marshal and also observe design guidelines regarding firefighter access in the International Association of Fire Fighters and the CEC 2022.
2. The Contractor shall invite local firefighters to a training where firefighters will be shown how the BESS works and how to shut it down, form a fire suppression plan, and shall work with the fire marshal to determine where to post the permanent instructions and required markings. The Contractor shall coordinate with local fire marshals on BESS setback requirements, first responder training, and posted instructions for shutoffs.

R. FEDERAL, STATE, AND LOCAL REBATES AND INCENTIVES
1. The Contractor shall complete and submit in a timely manner all documentation required to qualify each system for available rebates and incentives.

S. SUBMITTALS
1. The Contractor shall include BESS submittals, including:
   a. A site plan showing the BESS footprint
   b. Electrical schematic diagrams (interconnection, system one-line diagrams)
   c. Usable energy storage capacity (kWh)
   d. Rated power (kW AC)
   e. AC:AC efficiency (including auxiliary loads)
   f. Cycle life
   g. Annual degradation factor
   h. Ambient temperature control system
   i. Fire protection/suppression system description as required by code
   j. Equipment manufacturers and product names
   k. Battery Management System provider
   l. Maintenance requirements
2. The Contractor shall identify an appropriate location for the balance of system enclosure, and its related components and environmental control systems that will meet the following criteria:
   a. Ease of maintenance and monitoring
   b. Efficient operation
   c. Low operating losses
   d. Secured location and hardware
   e. Compatibility with existing facilities
   f. Minimum vegetative and landscape impact
3. All Balance of Systems (wiring, component, conduits, and connections) shall be suited for conditions for which they are to be installed.

T. OPERATIONS AND MAINTENANCE
1. The Contractor shall conduct annual O&M and continuous monitoring to verify that the BESS is performing as intended per the proposed battery storage strategy and manufacturer recommendations and submit an annual report to Owner. The report shall include:
   a. Use case performance

b. Battery outages with root cause summary and start and end time periods.
c. Summary of all O&M operations; repair and replacements
d. Summary of safety incidents, causes and resolutions
e. Contractor shall perform all required maintenance to the BESS and BMS to ensure that the monthly demand reduction is provided.
f. Contractor will provide O&M training and supporting manuals to Owner personnel.
g. Perform updates to the BMS dispatch strategy if required due to rate tariff or major site load profile changes.
h. Ensure that all system firmware is up to date and meets cybersecurity requirements.

U. DELIVERY, STORAGE, AND HANDLING
1. All equipment and panels shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.
2. Appropriate protective clothing shall be worn when handling the equipment. Such clothing shall include hard hats and steel-toe boots when lifting materials to roof, and insulated gloves when working on an active system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable system manufacturers/vendors shall have been in the business of producing and/or installing similar commercial grade systems for the last 5 years minimum. Manufacturers shall provide their latest line of equipment, meeting all current industry standards.

B. For basis of design systems, the minimum performance of the system shall match the physical and electrical equipment characteristics as shown on the electrical drawings.

C. PERFORMANCE
1. Grid outage scenario: Integrate the BESS with the PV and generator being provided as part of this project and automatic transfer switch (ATS). Install a microgrid control system and modify the existing ATS as necessary to provide electricity to the building upon grid failure.
a. Configure BESS to provide seamless transition between utility power and microgrid. Optimize system to minimize generator use to conserve fuel.
b. The BESS shall be demonstrated to perform on a recurring basis to ensure the Owner’s desired site resilience and energy assurance. This interval testing frequency shall occur approximately every twelve months following final acceptance to ensure provision of power to the site in the event of a utility-provided power outage or interruption. This activity requires pre-coordination with the servicing utility in accordance with the approved interconnection agreement, and that coordination shall be led by the Contractor in consultation with the Owner’s facilities management staff. This periodic demonstration shall stagger months, seasons, load, time of day, and weather variabilities, but shall be conducted at least every twelve (12) months. Periodic testing will be the responsibility of the BESS supplier. In the event of an actual utility power interruption exceeding 24 hours, the BESS’s

performance will satisfy this requested demonstration, thereby resetting the interval to twelve (12) months prior to the next required demonstration. Any deficiencies or anomalies beyond expected design parameters, in an actual event or demonstration event, are to be reported to the Owner within twenty-four (24) hours in writing, with recommended remediation or corrective steps to prevent recurrence.

2. Demand control scenario: Integrate the BESS to provide grid electricity usage and demand control/ peak shaving to limit demand (kW) to programmed setting. The BESS shall have a method for forecasting the peak load and automatically dispatching the battery or scheduling the charge/discharge in advance.
    a. Time of Use Charge Reduction: Integrate the BESS to discharge during on-peak hours in accordance with the site's rate tariff.
    b. A BMS (battery management system) shall be provided to control the charging and discharging of the equipment. The BMS shall be field programmable by connecting with a laptop and viewing/editing on a locally hosted web browser. Programming instructions and setpoints shall be shared with Owner staff.
    c. BESS shall maintain a round-trip efficiency greater than 70% AC-in to AC-out (confirmable by operation over a single round-trip cycle from 0% state of charge to 100%, and back to 0% at standard conditions specified by the manufacturer), including thermal losses and auxiliary loads, over 10 years.
    d. Contractor shall guarantee annual BESS savings as established in the proposal. Savings will be generated by discharging the battery during on-peak periods, as well as during peak billing demand periods. Contractor shall propose a methodology to calculate optimal savings, subject to review by Owner, and guarantee optimal savings.
    e. Operations and Maintenance for the first year of operation.
3. Solar-plus-Storage
    a. The awarded Contractor may be eligible for tax incentives associated with the PV and BESS. If so, the Contractor shall ensure that the BESS only charges from the solar PV system (except in emergency when the generator will back up the PV in the event that the PV is unable to maintain required minimum BESS output voltage), and that this PV-only charging is documented throughout the BESS operating life. Tax incentive eligibility due diligence shall be the responsibility of the Contactor and not the Owner.

D. THERMAL MANAGEMENT
1. The Contractor shall provide all components to operate the BESS within acceptable operating temperatures. Provide any thermal management systems and operating strategies required to maintain the BESS and inverter temperatures within manufacturer's recommendations at all times.

E. ARC FLASH AND COORDINATION STUDIES
1. The Contractor shall perform arc flash and coordination studies of the system to ensure safety during operation in parallel with the grid – see Section 262573 of the Specifications.

F. PROFESSIONAL ENGINEER AND LICENSED DESIGN PROFESSIONALS

1. All architectural and engineering (A-E) services shall be performed by design professionals licensed in the state in which the project is being built with responsible control for each respective design discipline.

G. REGISTRATION SEALS
1. Each submitted final design drawing, calculation document, and specification manual shall be signed and dated by, bear the seal of, and show the State Certificate Number of the Architect or Engineer who prepared the document and is responsible for its preparation.

H. COORDINATION OF PROFESSIONAL SERVICES
1. The Contractor shall be responsible for the professional quality, technical accuracy, and coordination of all investigations, evaluations, drawings, testing, cost estimating, submittals, written reports, construction, operations, and all deliverables, as required by this document or as required to complete the work of this contract.

I. COORDINATION OF SUBCONTRACTORS' CREDENTIALS
1. The Contractor shall ultimately be responsible for the completeness, accuracy, coordination, and submission of all submittals described above. Contractor may delegate the preparation of submittals to subcontractors or suppliers as long as the intent of Sections 2.5, 2.6, and 2.7 of this specification is met.

J. MODIFICATIONS AND ALTERATIONS OF OWNER PROPERTY
1. Modifications, alterations, and/or additions to existing facilities shall be designed and certified to satisfy applicable requirements of this Statement of Work (SOW) document and the governing codes and standards referenced in this SOW document. Owner shall coordinate with building occupants and approve all modifications, alterations and/or additions prior to completion of design.

K. GROUNDING
1. A suitable equipment grounding system shall be designed and installed for the BESS. The grounding system shall provide personnel protection for step and touch potential in accordance with IEEE 80. The system also shall be adequate for the detection and clearing of ground faults within the BESS. The system should be grounded in all anticipated operating modes (e.g., grid-tied and islanded).

L. STRUCTURAL
1. The vendor shall furnish the design for the structural components of the BESS, concrete pads/foundations as required, and conduit required for the complete BESS. All final (Issued for Construction) drawings, specifications, and calculations shall be stamped by a state-licensed Civil/Structural Professional Engineer. The vendor is responsible for Geotechnical surveying if required.

M. CONDUIT AND PREVENTING WATER INTRUSION
1. Conduit routing and fittings must be selected to prevent water intrusion into inverter enclosures, combiner boxes, switchgear, and transformers. Conduits are to connect through the bottom of enclosures and provide fittings to allow water to drain prior to entering the electrical enclosure. Any exterior PVC conduit must be Schedule 80.

N. LOCATING EQUIPMENT
1. Major electrical components, including the inverter, isolation transformer, and metering, shall be installed in code-compliant enclosures. BESS location shall be above the 20 year flood plain and surge levels and shall be elevated higher than any pull vaults and conduit not sloped toward any BESS electrical component in order to prevent equipment flooding. BESS shall be located within a thermally conditioned enclosure.

O. EXPECTED SERVICE LIFE
1. Unless noted otherwise, all materials furnished for the project shall have an expected service life of at least 10 years.

P. SITE SERVICE CONDITIONS
1. Materials shall be designed to withstand the year-round temperatures and conditions to which they are exposed (sunlight, heat, humidity, rain, wind, sand/dust, seismic activity, salt air, fog, marine corrosiveness, etc.)

Q. NEW EQUIPMENT
1. The Owner shall not accept used, reconditioned, after-market, or grey-market products or equipment. Any offeror supplying used, reconditioned, after-market, or grey-market products may be held responsible for damages to the Owner.

R. MARKINGS (LABELING)
1. Strict conformance to system marking requirements of BESS and their components is crucial for the safety of operators, service personnel, emergency responders, and others. Include all required and desired labeling language in the design drawings for Owner review.
    a. Electrical equipment and components used in BESS shall have markings that identify the manufacturer, size, type, ratings, hazard warnings, and other specifications.
    b. Labelling shall include posted instructions for tasks that site staff may need to perform, such as system shutdown during an emergency.
    c. All disconnects shall be clearly labelled, indicating operating system voltage, current, and system rating.
    d. Equipment markings should never be removed and should be able to withstand the environmental conditions in which the equipment is installed (e.g., “UV rated” for outdoor labels, or on an embossed steel placard, designed for outdoor use and fastened with adhesive and rivets).
    e. Markings must be visible or easily accessible during and after installation. The Contractor shall be responsible for all field-applied markings as required by local, state, and federal codes.

S. DATA ACQUISITION AND MONITORING
1. Contractor shall provide a turnkey data acquisition and display system that allows the Owner to monitor, diagnose, and track the charging, discharging, and operating data of the BESS. Minimum requirement is the provision of a web-based monitoring and tracking system. Contractor shall provide internet connection to the BESS, distinct from Owner internet. Ensure that the data acquisition and monitoring solution is compliant with Owner cybersecurity. Monitoring and tracking systems shall include a historical database and real time

data portal capturing the data in 15-minute intervals. A minimum of 36 months of data shall be stored by the Contractor and be made available for Owner download via the web portal. The data shall, at a minimum, comprise the following information and frequency of collection:

a. Date, time.
b. Apparent power (kVA)/phase, real power (kW) and Volts on each phase; recorded in 15-minute intervals.
c. BESS state of charge
d. Ambient temperature, hourly average at hourly intervals, either from on-site measurements or a reliable climate data service.
e. The web-based monitoring system shall report actual system performance and an estimate of expected performance.
f. The system shall allow Contractor to interact with BESS BMS to update settings and modify setpoints.

T. BESS SAFETY
1. The BESS shall have a Data Acquisition/monitoring/alarm system. System shall be described in the offeror's proposal and shall include:
   a. Full monitoring of electrical power and related operational data, including voltage, current, and system temperature.
   b. Visual and audible alarm if potential safety hazard exists.
   c. Notification when preventive maintenance is needed.
   d. System level alerts shall be provided by the manufacturer over customer interface.
2. The BESS shall contain protective relays, circuit breakers, or fuses which self-protect the BESS in the case of internal electrical faults. Set and adjust circuit protection devices according to a short circuit and coordination study.
3. A detailed plan surrounding battery cell thermal runaway detection and mitigation systems in the BESS will be included in the submittal process.
4. A visible disconnect shalll be installed that isolates BESS in accordance with utility interconnection requirements.
5. All electrical equipment, enclosures, disconnects, and overcurrent devices shall be clearly marked and identified. Markings shall reference the same designations called out in the final design drawings.
6. A fire detection/suppression system shall be provided as required by code or by manufacturer.
7. Develop posted instructions for tasks that site staff may need to perform, such as system shutdown during an emergency.

U. SEVERE WEATHER
1. Earthquake Mitigation—Comply with UFC 3-301-01 for requirements related to the foundation, soil stability, and seismic analysis.
2. Flooding/Other Water Intrusion Considerations
   a. Use NEMA 3R rated or better enclosures
   b. Coordinate with Civil Engineer to ensure a comprehensive site stormwater management and drainage plan that encompasses location of BESS out of path of stormwater flows.
   c. In addition to code requirements, design shall prevent scour of soils in and around BESS to prevent loss of foundation integrity.

PART 3 - EXECUTION

3.1 COMMISSIONING

A. A commissioning plan shall be provided by Contractor and approved by Owner prior to proceeding with inspection and commissioning:
   1. After Owner's utility provides permission (interim for testing) to operate in parallel with the grid, the Contractor shall complete commissioning in accordance with Owner safety and commissioning plans, its own quality-control plan, manufacturer's recommendations, and franchise utility interconnection requirements. The Contractor shall document all performance measurements.
   2. The Contractor shall perform all work required for testing, start-up, and commissioning.
   3. The BESS shall be commissioned per the Electric Power Resource Institute (EPRI) "ESIC Energy Storage Commissioning Guide", or by a similar standard reviewed and approved by Owner.
   4. Contractor shall give Owner ten (10) business days advance notice prior to starting commissioning. An Owner manager or representative shall be present during any or all phases of the start-up, commissioning, and testing activities.
   5. The system shall be started-up and tested in accordance with the regulations of the applicable interconnection standards. All possible anticipated modes of operation shall be tested (grid-tied, islanded).
   6. The Contractor shall request and coordinate System Acceptance Testing with the utility and Owner for acceptance and certification of the BESS and permission to operate, after commissioning and final inspections are complete.
   7. Commissioning shall include the Contractor's Data Acquisition System and enclosure thermal conditioning system.
   8. A commissioning report shall be provided to Owner.

B. INSPECTIONS
   1. The Project Manager or the delegated Project Manager's Representative may inspect the Systems at any time during construction or after the Systems have been put in operation. The Contractor may be ordered to stop work, or shut the systems down, if unsafe conditions or code violations are noted.
   2. An initial inspection for Substantial Completion will be made when the work is complete to the point that the Contractor is ready to begin starting, testing, and commissioning the system. Following this inspection, the Owner will provide the Contractor with a punch list describing any incomplete work that must be complete prior to the Contractor's request for final inspection.
   3. The Contractor shall give the Project Manager ten (10) business days advance notice, in writing, of the date the work will be ready for initial inspection.
   4. A final inspection of all Systems shall be made only when all construction is complete in accordance with the terms and conditions set forth in the Contract and all punch list items identified in the initial inspection are complete. If, upon examination by the Project Manager and/or Owner inspection personnel, the project is determined not sufficiently completed to have warranted a final inspection, the Contractor may be charged for any additional cost of re-inspection.

5. The Contractor shall give the Project Manager ten (10) business days advance notice, in writing, of the date the work will be fully completed and ready for final inspection.
6. The Contractor's request for final inspection will not be approved unless documentation below, at a minimum, has been provided to, and accepted by, the Project Manager, in addition to all other contract requirements:
   a. Final as built drawings (record drawings), meeting as-built requirements
   b. Preventive maintenance work schedules and procedures
   c. Operation and maintenance manuals (electronic and hardcopy)
   d. Training manuals (electronic and hardcopy)
   e. Equipment documentation and spare parts lists
   f. Certificates of Authority Having Jurisdiction (AHJ) inspections
7. After commissioning is complete, the Contractor shall instruct and train Owner designated personnel on normal system operation and how to shut down the System in the event of an emergency. Owner may reasonably request additional training and Contractor will conduct such training at Contractor expense. Training may take place over multiple sessions to accommodate Owner's staff availability. The training session(s) may be recorded.
8. As soon as practicable, following final inspection, the Project Manager will inform the Contractor, in writing, of any discrepancies and/or omissions noted at the final inspection. The Project Manager shall also state the time allowable for replacement of material and performance or re-performance of any unsatisfactory work necessary before written notification of System Acceptance Testing.
9. Upon written notification that all deficiencies identified during the final inspection have been corrected, the Project Manager may schedule a follow up inspection to confirm all correct work is acceptable. Contractor shall then coordinate with utility, Owner, and any other AHJ to schedule System Acceptance Testing.

C. SUMMARY OF PROCESS
   1. In summary, inspections and commissioning will follow the following sequence:
      a. Initial inspection for Substantial Completion of construction
      b. Commissioning may begin concurrently with the initial inspection
      c. Final inspection may be scheduled following completion of commissioning and approval of all documents shown in Section 3.2(vi) of this specification
      d. Contractor will be responsible for completing any re-work identified in the Final inspection prior to scheduling System Acceptance Testing

D. FINAL ACCEPTANCE
   1. The Contractor shall notify the Owner not less than ten (10) business days prior to the anticipated date of System Acceptance Testing. The Owner shall be present at and observe the System Acceptance Testing, at the Owner's sole cost.
      a. The System Acceptance Testing shall be witnessed by utility if required for interconnection approval and the Contractor shall meet the utility's test notification requirements.
      b. In addition to utility and Owner System Acceptance Test standards, the test shall include, at a minimum, the following:
         1) While connected to grid power, start up the BESS until it achieves the minimum specified performance requirements. The acceptable productive power output will be measured in kW (AC) at the building

electrical interconnection point and must be consistent with the specifications for the system.

2) Contractor shall demonstrate the operation of one full charge/discharge cycle of the BESS and report on system performance.

c. Approvals as required by the fire marshal and local electric utility will be a pre-requisite for acceptance and for authorization to energize the system(s).

2. Upon successful completion of System Acceptance Testing, Contractor shall send a Completion Notice and a copy of the System Acceptance Test report to the Project Manager so that the Owner can complete their final acceptance. Owner shall have ten (10) Business Days after receipt of the Completion Notice to review the System Acceptance Testing results and verify that the System installation is complete, safe, aesthetically acceptable, functional, constructed to all code requirements, does not interfere with Owner or tenant operations, and otherwise meets all other requirements. The Project Manager will notify the Contractor in writing of Final Acceptance.
3. If any of these requirements are not met, then the Owner shall provide Contractor with a detailed notice of such failure (a "Rejection Notice") within the ten (10) business day period, with details regarding the required remedy (including repeat of either partial or full System Acceptance Testing, if appropriate, at the discretion of the Project Manager or Project Manager's Representative, and the time allowed to complete remedy. The Contractor shall promptly remedy, at Contractor's cost, the items identified in the Rejection Notice and conduct any additionally required System Acceptance Testing (if required by the Rejection Notice) until the System Acceptance Testing indicates that the System meets the contract requirements. In each such case, the Contractor shall send a new Completion Notice to the Owner with a copy of the results of the new System Acceptance Testing as provided above and the foregoing procedures shall be repeated.
4. Written acceptance shall be final and conclusive except as regards latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's right under any warranty or guarantee, subject to the system performance warranty.
5. In summary, the following requirements must be fulfilled before final acceptance:
   a. System Acceptance Testing has been completed, with the System having operated at specified performance for one full charge/discharge cycle with power production levels consistent with proposed System's estimated production with 100% system availability, measured with applicable instruments and meters.
   b. The System has been approved for interconnected operation by utility (with signed interconnection agreement).
   c. Submission of as-built drawings and all documents required prior to final inspection described in Section 3.2 of this specification.
   d. Training fulfillment documentation.
   e. Commissioning report provided to Owner.

END OF SECTION

SECTION 26 51 01

LIGHTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Luminaires (i.e., lighting fixtures): Refer to the Luminaire Schedule and provide a complete and working facility Lighting System. Catalog numbers in the Luminaire Schedule are design series references and may not represent the exact catalog number as specified or as required for particular installations. Provide complete luminaires to correspond with the number of LEDs, power supply, wattage, mounting hardware, ceiling type, trim, size, and special requirements as specified in the Luminaire Schedule for each luminaire type. Additional features, accessories, and options specified, described, scheduled, or necessary for installation shall be included.

B. LEDs and power supplies.

C. Lighting controls, including occupancy sensors. See Section 26 57 00 for Low Voltage Lighting Control System.

D. Exit and Emergency Egress lighting where indicated and where required.

E. Supports for outlet boxes and luminaires, including seismic restraint slack wires for recessed luminaires in suspended ceilings per code and backing in walls as required to keep luminaires secure and level.

1.2 INCORPORATED DOCUMENTS

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

B. Section 26 05 00 and 26 27 00 apply to all work in this section.

C. Division 03: Concrete (Bases for pole-mounted luminaires as noted in Luminaire Schedule).

D. Division 09: Painting and Finishes (cutting of holes in finished surfaces for recessed luminaires).

1.3 RELATED WORK

A. Ceiling Access panels where required for access to equipment, outlets, transformers, etc., located above suspended ceilings, sheet rock or plaster ceilings. Coordinate with the Architect and other trades.

1.4 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Submit (6) six sets of submittals for review by the project team unless otherwise noted in these specifications. The submittals shall include the following information:
   1. Product Index: The following information shall be included in the product index.
      a. Luminaire Type. The index shall list, in alphabetical order, each luminaire type per the Luminaire Schedule.
      b. Manufacturer’s Catalog Number. Outstanding information required to make a complete catalog number shall be clearly identified in the index.
      c. Where a pole is included with the luminaire, include the catalog number of the pole in addition to that of the luminaire.
      d. LED Data. Provide the Manufacturer’s name for each LED array including wattage, color temperature, lumen output, and color rendering index.
   2. Manufacturer's literature for every luminaire listed on the Luminaire Schedule.
      a. Catalog Information:
         1) Luminaire Data Sheet: The manufacturer’s cut sheet shall include the following:
            (a) Photometrics: Candlepower distribution curve or table with horizontal readings at 0, 22.5, 45, and 90 degrees and vertical readings from 0 to 180 degrees in 5 degree increments in accordance with the Illuminating Engineering Society published test procedures.
            (b) Catalog Number Nomenclature
            (c) Coefficient of Utilization Tables
            (d) Luminaire Line Drawing
            (e) Power supply (each type)
   3. Data sheets for electronic ballasts and power supplies. Indicate luminaire types on applicable ballast/power supply data sheets.
   4. Data sheets for wallbox controls and other products specified in this section.
   5. Shop Drawings:
      a. Provide shop drawings of suspension details for luminaires recessed in, mounted on, or suspended from hung ceilings. Details shall clearly illustrate proposed methods for supporting luminaires independent of the suspended ceiling system.
      b. Detailed shop drawings of pendant mounted luminaires constructed with linear metal housings containing the following information.
         1) Support mechanism, including swivel canopies.
         2) Trim details.
         3) Closure piece details.
         4) Pattern configurations.
   6. Samples:
      a. Provide samples of luminaire trim where "Finish as selected by Architect" is indicated on the Luminaire Schedule. Submit two finish samples, 75 mm x 75 mm (3" x 3") minimum, of all custom color, decorative metal, or anodized aluminum finishes. Samples must be approved in writing by the Architect prior to ordering.

C. For Any Luminaires Substituted For Those Specified:

1. Refer to Division 1 - Product Requirements, for all substitution procedures.
2. Provide Independent Testing Laboratories, Inc., or equal, photometric test report for each Luminaire type and lamp combination listed on the Luminaire Schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain polar coordinate candlepower distribution curves in five lateral planes for luminaires with asymmetric distributions and luminaire luminance data for vertical angles above 45 degrees from nadir. Test results shall indicate luminaire efficiency for the lamp and aperture assembly specified. luminaires with efficiencies more than 2% below the values of specified luminaires are not acceptable and will be rejected.
3. Provide photometric calculations for each room or area where a substituted luminaire is proposed. Such calculations shall be made using comprehensive lighting software, such as AGi32, and include point-by-point illuminance values at IES recommended heights, average illuminance, and maximum-to-minimum and average-to-minimum uniformity ratios. Room dimensions, configurations (including sloping ceilings), room surface reflectances, light loss factors, and heights of suspended luminaires shall match the heights specified in the contract documents.
4. Due to the variety of lumen outputs and light distributions of LED Luminaires, substitutions will require additional review on the part of the Engineer or Architect to ascertain the equivalency of the substituted luminaires. Substitutions will be reviewed to determine their aesthetic, construction, and photometric equivalency to maintain similar design impact and performance in their intended environment. The Engineer and Architect have not included such unknown and unquantifiable review time in their scope of work and are not compensated by the Owner for such services. The Contractor shall reimburse the Engineer and Architect for labor costs to review substitutions.
5. Prior approval does not guarantee final approval by the Engineer. The Contractor shall be responsible for providing luminaires that meet or exceed the quality and performance of the specified products in their entirety. All deviations in quality and performance from the specified products must be listed and individually signed off by the engineer.
6. The Owner reserves the right to reject a proposed substitution based on their agent’s professional judgment as to the utility, quality, performance, visual appropriateness, or finish of substitutions.

1.5 OCCUPANCY SENSORS

A. Equipment Qualification
   1. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.
   2. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
   3. Contractor and Contractor's Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

4. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, luminaires, HVAC systems and building management systems.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site and store in unopened cartons in protected location. Inspect products immediately and report all damage accordingly.

1.7 GUARANTEE AND WARRANTIES

A. All work performed under this section must be guaranteed to be free of defects in products or workmanship for one year after date of acceptance by Owner, unless noted otherwise in General Conditions.

B. Warranties:
1. Electronic power supplies must be warranted against failure for at least five years after date of substantial completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide luminaires as indicated in Luminaire Schedule; if conflict exists between Luminaire Schedule and Specifications, the more stringent requirement shall take precedence.

B. Provide luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.

C. Provide products with UL labels appropriate to intended installation conditions, or with labels from other testing laboratories whose results are acceptable to local inspector, showing compliance with UL standards. Labels must be concealed from normal viewing angles.

D. All products of same type by same manufacturer.

2.2 SOLID STATE LUMINAIRES

A. Housing, where applicable:
1. Steel bonderized or equal rust protected, or aluminum, rigid construction. Minimum gauge thickness shall be as follows:
a. Interior locations: No. 20-gauge steel, No. 16-gauge aluminum.

B. Finish:
1. Baked enamel finish (except when otherwise specified).
a. Concealed interior surfaces (this applies to interior hardware, circuit boards, etc.) matte black.
b. Concealed exterior surfaces: matte black.

c. Visible surfaces: color and texture as specified below for each luminaire type or as selected.

C. Light Emitting Diode (LED) requirements:
1. Correlated color temperature (CCT) for phosphor-coated white LEDs must have one of the following designated CCTs, as specified on the Luminaire Schedule, and fall within the following binning standards.
a. 3000K defined as 3045 +/- 175K
b. 3500K defined as 3465 +/- 245K
2. Color spatial uniformity shall be limited to variations in chromaticity for different directions (i.e. changes in viewing angle) within 0.004 from the weighted average point on the CIE 1976 (u',v') diagram.
3. Color maintenance shall be limited to a maximum change in chromaticity of 0.007 on the CIE 1976 (u',v') diagram over the lifetime of the product.
a. Color rendering index: Color rendering index to be determined using ANSI C78.377-2008 and applicable IESNA standards.
b. Laboratory tests must be produced using specific module(s)/array(s) and power supply combination that will be used in production.
c. Manufacturers must provide a test report from a laboratory accredited by NVLAP or one of its MRA signatories
4. Lumen depreciation
a. Lumen depreciation to be measured using IESNA LM-80-08 and TM-21-11 standard for IES approved method of measuring lumen maintenance of LED light sources.
b. Phosphor-coated white LED modules/arrays shall deliver at least 70% of initial lumens for a minimum of 50,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
c. Colored LED modules/arrays shall deliver at least 50% of initial lumens for a minimum of 50,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
5. Acceptable LED manufacturers:
a. Cree
b. Nichia
c. Osram Opto Semiconductors
d. Philips Lumileds
e. Xicato

D. Luminaire Efficacy:
1. Luminaire efficiency shall be measured using IESNA LM-79-08 standard for electrical and photometric measurements of solid state lighting products.
2. Manufacturer shall provide published luminaire efficacy, which is defined as luminaire light output divided by luminaire input power measured in a 25 degree Celsius environment. Efficacy shall include power supply, thermal, optical, and luminaire losses.

E. Thermal Management:
1. Solid state luminaire shall not exceed LED manufacturer's maximum junction temperature requirements when operated in-situ at luminaire manufacturer's maximum ambient operating temperature and 100% light output.
2. Solid state luminaires shall be thermally protected using one or more of the following thermal management techniques:

a. Metal core board
b. Gap pad
c. Internal monitoring firmware

3. Solid state luminaire housing shall be designed to transfer heat from the LED board to the outside environment.

F. Power Supplies (LED Drivers) requirements:
1. Power factor of 0.90 or greater for primary application
2. Input current shall have Total Harmonic Distortion (THD) of less than 20%.
3. Minimum operating temperature of minus 20 degrees Celsius or below when used in luminaires intended for outdoor applications.
4. Operating frequency equal to or greater than 120 Hz.
5. Operate with sustained input variations of +/- 10% (voltage and frequency) with no damage to the driver.
6. Tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
7. Output shall be regulated to +/- 5% across published load range.
8. Class A sound rating.
9. Outputs shall have current limiting protection.
10. Operate LEDs at constant and regulated current levels. LEDs shall not be overdriven beyond the diode manufacturer's specified nominal voltage and current.
11. Inrush currents not exceeding peak currents specified in NEMA 410.

G. Solid State Lighting Controls:
1. Control interface to dimmable power supplies shall consist of one of the following:
a. Line Voltage Dimming. Controls to be rated for magnetic or electronic low voltage transformer operation.
b. Low voltage (0-10V) control. Controls to be compatible with either current sink or current source operation.
2. Dimmable LED power supplies shall use pulse width modulation (PWM) or constant current reduction (CCR) to regulate power to LEDs.
a. PWM power supplies shall have 12-bit or greater resolution to obtain flicker-free operation throughout their dimming range.
b. PWM power supplies shall be provided in luminaires that will be dimmed lower than 40% and must maintain consistent color temperature.
c. CCR power supplies shall be provided in areas that have strict electromagnetic interference (EMI) requirements, high motion activity, or rotating machinery.

H. System Installation
1. Hardwired connections to solid state luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
2. All solid state luminaires (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing. Solid state lighting installations shall be UL Listed as a low-voltage lighting system including, but not limited to, luminaire, power supply, controller, keypad, and wiring.

I. Warranty

1. Luminaires, drivers, and controllers for solid state lighting systems shall be covered by a five-year warranty against defects in workmanship or material. Warranty shall include in-warranty service program providing for payment of authorized labor charges incurred in replacement of inoperative in-warranty equipment.

2.3 LUMINAIRE CONSTRUCTION

A. Sheet metal: materials and thicknesses shall be 20 gauge (0.7 mm or 0.027") min., free of dents, scratches, oil-can, or other defects.

B. Painted luminaires: exposed weld marks, joints, and seams shall be filled and sanded smooth before finishing.

C. All edges cleaned and dressed to remove sharp edges or burrs.

D. Extrusions: 1/10" min. wall thickness, smooth and free of tooling lines, with cast end plates that exactly match extrusion profiles.

E. Castings: smooth, free of pits, scales, gate marks, or blemishes.

F. Spinnings shall have 1/32" min. thickness, smooth, free of spinning lines or blow-back, with clean edges.

G. Welds: Follow recommendations of American Welding Society. All welds continuous and free of spatter, residue, or warping.

H. No light leaks visible in finished room. Ensure that downlight housings mounted in wood slat ceilings are not visible from below. Field paint exterior of housing with high temperature paint if necessary.

I. Exposed end plates and joiners, with concealed fasteners.

J. End-to-end mounted luminaires: Verify row configurations and provide joiners, aligning splines, and trims to suit.

K. Hardware:
   1. Steel or aluminum interior luminaires: cadmium-plated hardware.
   2. Steel or aluminum exterior luminaires: stainless steel hardware.
   3. Stainless steel luminaires: stainless steel hardware.
   4. Copper alloy luminaires: brass hardware.

L. Raceways: Where used for through wiring, luminaires must be approved for use as raceways.

2.4 RECESSED LUMINAIRES

A. Point-source luminaires: provide pre-wired junction box and thermal protection, and provide slack wires to structure at two diagonal corners.

B. Troffer luminaires: provide hold-down clip at each luminaire corner, and slack wires to structure as detailed on the drawings. The detail will take precedence.

C. Verify ceiling construction details and provide luminaire housings and trims to suit.

D. Non-accessible ceilings: Provide access to junction boxes, ballasts, transformers, and battery packs through luminaire apertures; no access panels in ceiling.

E. Mounting frames: To prevent rusting, provide galvanized steel or cast aluminum frames for installation in damp locations or in plaster ceilings.

F. Adjustable luminaires shall be provided with rotation and tilt locking devices.

2.5 PENDANTS

A. Cable-mounted: 1 X 7 strand 3/32" diameter stainless steel aircraft cable, factory crimped, independently tested and verified to exceed 1500 pounds.
   1. Verify mounting heights for each luminaire and provide cable lengths and coordinate cord lengths with manufacturer as required prior to ordering luminaires. Provide aircraft cable adjuster nipple with locking jaws.

B. Supports: Carry luminaire weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.

2.6 TRIMS

A. Trims must fit tightly and be held in by gravity, spring clips, or mechanical fasteners. Trims must not drop out under normal conditions or seismic forces which do not exceed the design criteria of the building.

B. Aluminum parabolic cones shall be smooth, properly shaped, with Alzak finish in colors as indicated.
   1. No hot spots or lamp images visible at angles shallower than lamp shielding angle.
   2. Self-flange cones must bend parallel to ceiling and cover ceiling hole without additional trim ring. Unpainted flange, shall have the same finish as cone interior.
   3. Cones and louvers for fluorescent luminaires must have permanent anti-iridescence treatment.

C. Lenses, diffusers, and patterned glass: glass or virgin acrylic as noted, with patterns as noted.
   1. Finished thickness 2 mm (1/10") min. unless noted otherwise.
   2. Linear runs over 1200 mm (4'-0") long shall be in equal-length pieces.

2.7 FINISHES

A. Steel Reflectors: Unless otherwise specified, the reflector surface finish shall be of synthetic white enamel or polyester powder coating. Finish shall show no indication of chipping, cracking, flaking or any other sign of loss of adhesion. The initial reflection factor shall be not less than 88 percent averaging 5 randomly selected points on the reflector. After 100 hours of exposure to the radiation of a glass enclosed carbon arc lamp, such as a Fade-O-Meters, the reflectance of the exposed portion shall not be less than 5 percent and finish shall show no appreciable color change. The carbon arc lamp shall be operated at appreciable color change. The carbon arc lamp shall be

operated at 13 plus or minus 0.5 amperes at 140 volts. The reflector shall be placed ten inches from the arc and the lamp so ventilated that the temperature of the exposed portion does not exceed 105 degrees F.

B. Aluminum Reflectors: Reflecting surfaces shall be provided with either a specular or diffuse finish as indicated. Reflection factors shall be not less than 83 percent for specular reflecting surfaces. Each reflecting surface shall be protected by dense coating of oxide weighing not less than 5.0 milligrams per square inch, applied by an anodic process. The reflector shall be given a sealing treatment that will prevent staining of the reflecting surface when subjected to a stain test. All aluminum reflectors & louvers shall be a low iridescent equivalent to that provided by Coil Anodizers.

C. Non-Reflecting Surfaces: Unless otherwise specified, the finish on all non-reflecting exterior surfaces shall be aluminum oxide or aluminum; white, gray or aluminum paint on steel; nickel or chromium plating on copper alloy. Fastening devices shall be nickel, chromium, cadmium or zinc plated. All painted surfaces shall be free of tears, star marks, blisters, pinholes, chipping and any other defects that may impair appearance or serviceability.

2.8 LAMPS

A. Replace LED boards and power supplies at no cost to owner if lamps or LEDs exhibit color variation, flicker, or burn out within 90 days of substantial completion date.

B. LEDs:
   1. LED quantity, wattage, and color temperature as specified for each LED luminaire.
   2. 3500 deg. K color temperature for interior luminaires, 3000 deg. K for exterior luminaires, unless otherwise specified.

2.9 DRIVERS AND TRANSFORMERS

A. General:
   1. Verify input voltages and match to branch circuit voltages.
   2. Remote drivers or transformers: Provide suitable enclosures and mounting hardware, and install in accessible, ventilated locations.
      a. Secondary wiring: provide number and size of conductors as required, with 3% max. voltage drop between transformer and last lamp.
      b. Keep transformers at least 300 mm (12”) apart and do not stack vertically.

B. LED Drivers:
   1. High power factor, thermally-protected.
   2. Compatible with LED lamps being used.
   3. Capable of dimming LED source without perceptible flicker or stroboscopic effects.

2.10 EMERGENCY LIGHTING AND EXIT SIGNS

A. Emergency lighting:

1. Provide lighting for paths of egress as required by Code.

B. Exit signs shall be edge or back lit LED, surface-mounted on ceiling or wall.
   1. Fabricated aluminum construction, no light leaks around canopy. Plain box, with no decorative trim.
   2. Letters shall be 20mm (3/4”) stroke, 150 mm (6”) high, with concealed knockouts for left or right arrows, brightness and evenness of illumination per code, green color.
      a. Green LED lamps located at interior perimeter for indirect illumination of stencil letters.
      b. Provide finish as specified in the Luminaire Schedule.
      c. Knock out the arrows as indicated on the plans.

C. Emergency luminaires supplied by a separate emergency power source.
   1. For luminaires supplied by a separate emergency power source, provide "switched" control of the emergency designated lamps to allow complete "off" control when required by the user. The switched control shall include an automatic transfer feature to automatically turn "on" the emergency designated lamps upon the normal source power failure.
   2. Automatic control function shall be provided using a UL 924 listed relay, LVS Inc. #EPC-A or equal, suitable for mounting in a standard 4" square j-box (min. 2.5" deep). Control relay shall provide automatic diagnostic test feature which shall maintain power to the emergency designated lamps for 15 seconds after the room is switched off via the respective light switch or control relay. Emergency designated lamps shall turn off after the 15 second test period and shall come back on when the control device is turned back on to restore full lighting to the space.
   3. Provide (1) control module per "switched" zone.

D. Emergency luminaires supplied by a dimmer panel and/or emergency source.
   1. For luminaires supplied by a dimmed power source, provide "dimmed" control of the emergency designated lamps to allow normal dimming control with the normal lamps. The dimmed control shall include an automatic transfer feature to automatically turn "on" the dimmed lamps to full light output upon the normal source power failure.
   2. Automatic transfer function shall be provided using a UL 924 listed relay, LVS Inc. #EPC-D (2-wire dimmed), #EPC-D-U (3-wired dimmed) or equal, suitable for mounting in a standard 4" square j-box (min. 2.5" deep).
   3. Provide (1) transfer module per "dimmed" zone.

2.11 WALL-BOX DIMMERS

A. Provide dimmer controls as specified on the drawings and in Specifications Section 26 57 00.

B. Ganging and Labeling:
   1. Dimmers and matching switches in same location shall be installed in same gang box.
   2. Labels: text as indicated 3 mm (1/8”) high, all capital letters, engraved on device faceplate, filled with black paint and wiped clean.

2.12 OCCUPANCY SENSORS

A. General
1. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
2. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180° coverage capability.
3. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
4. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
5. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
6. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
7. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
8. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.
9. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
10. Where specified, passive infrared and dual technology sensors shall offer daylighting foot-candle adjustment control and be able to accommodate dual level lighting.
11. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.
12. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
13. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
14. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
15. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
16. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
17. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
18. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control

shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

19. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
20. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
21. All sensors shall have UL rated, 94V-0 plastic enclosures.

B. Circuit Control Hardware - CU
   1. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
   2. Relay Contacts shall have ratings of:
      a. 13A - 120 VAC Tungsten
      b. 20A - 120 VAC Ballast
      c. 20A - 277 VAC Ballast
   3. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
   4. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

C. Acceptable Manufacturers
   1. The Watt Stopper, or Pre-Approved Equal: For pre-approval, provide all the information listed under “submittals” a minimum of ten (10) working days prior to initial bid date.
   2. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for sensors that meet or exceed the specifications and the requirements of the contract documents.
   3. Products
      a. All products shall be Watt Stopper product numbers:
         1) Ceiling sensors: WT-605, WT-600, WT-1105, WT-1100, WT-2205, WT-2200, WT-2250, WT-2255, W-500A, W-1000A, W-2000A, W-2000H, WPIR, DT-200, DT-205, CX-100, CX-105, CI-200, CI-205
         2) Wall sensors: WI-200, WS-120/277, WA-100, WD-170, WD-180, WD-270, WD-280
         3) Power and Slave Packs: B120E-P, B277E-P, C120E-P, C277E-P, S120/277-P, AT-120, AT-277

PART 3 - EXECUTION

3.1 PREPARATION

A. Architectural Reflected Ceiling Plans and Elevations shall govern exact location and mounting conditions for all luminaires. Contractor shall coordinate luminaire mounting and compatibility with ceiling construction and other trades.

B. Coordinate work with other trades. Location of lighting has priority over location of new framing (except major structural members), ducts, diffusers, sprinklers, speakers, smoke detectors, and other obstructions.

C. If obstructions are encountered which prevent installation of luminaires according to drawings, notify Architect immediately and do not proceed until conflict has been resolved.

D. Coordinate the location of luminaires in mechanical or unfinished spaces. Locations shown on Drawings may be adjusted by the Contractor to suit conditions. Install luminaires to avoid obstructions and maximize light output, 2100 mm (7'-0") min. mounting height.

E. In Elevator Machine Rooms, locate the luminaires so that the illumination level at the floor is not less than 200 lx (19 fc). Illuminate areas in front of and behind (if accessible) controllers, machines and other elevator equipment.

F. In Elevator Pits, locate the luminaires so that the illumination level at the pit floor is not less than 100 lx (10 fc).

G. Coordinate the location of any exposed conduit used to feed luminaires with the Architect prior to installation.

3.2 INSTALLATION

A. General:
   1. Contractor shall be responsible for handling and installation of luminaires including all supports, hangers and hardware necessary for a complete installation. Luminaires shall be clean, plumb, level in straight lines, without distortion. Luminaires must be installed so they do not shift during relamping or adjustment. Remedy any light leaks which may develop after installation of recessed or enclosed luminaires.
   2. Install luminaires at locations and heights as indicated, in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that luminaires fulfill requirements.
   3. Point-source luminaires shall be located as dimensioned, or in center of tile or on tile joint as drawn; 6 mm (1/4") max. off-center tolerance.
   4. Linear luminaires shall have 3 mm (1/8") max. horizontal or vertical alignment variation in any 5 m (16-ft.) portion of run.
   5. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated,

tighten connectors and terminals to comply with tightening torques specified in UL Stds. 486 A and B, and the National Electrical Code.

6. Clean luminaires of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.
7. Remove and replace luminaires that may have been damaged during construction at no additional cost to the Owner.
8. Protect installed luminaires from damage during remainder of construction period.
9. Provide equipment grounding connections for luminaires as indicated. Tighten connections to comply with tightening torques specified in UL 486 A to assure permanent and effective grounds.
10. Install luminaires, lamps, lenses, etc., after building is enclosed, weather tight and environmental conditions are nominally the same as expected for the complete spaces. All lenses, glass, reflectors, and refractors shall be clean and free of chips, cracks, and scratches.
11. All wall mounted luminaires and all ceiling mounted surface luminaires including exit lights shall be fed through a luminaire Stud/Hickey/Nipple assembly and with provisions to prevent luminaire turning.
12. Installation of exit signs shall be coordinated with other trades to ensure signs are visible as intended.
13. All junction box cover plates for the lighting branch circuit system shall be clearly marked with a permanent ink felt pen identifying the branch circuit and control relay (panel number, circuit number, lighting control cabinet designation and control relay number) contained in the box.
14. Provide permanently affixed adhesive labels with machine printed lettering (min. 1/8" high) at junction boxes serving luminaires that are supplied by (2) electrical sources (i.e. normal and emergency lighting). Label to read "CAUTION - This luminaire is powered by (2) separate sources. The normal power source breaker and the emergency power source breaker must be turned off before servicing this luminaire."

B. Recessed Luminaires:
   1. The contractor shall verify the fire rating of the ceiling system and wall in which the luminaires are to be mounted. Where luminaires are installed in fire rated ceilings or walls, provide fire rated enclosures around and over luminaires to maintain ceiling fire rating. No additional cost shall be allowed for failure to include such enclosures and installation in the bid.
   2. Holes for Recessed Point-Source Luminaires: Cut holes to follow luminaire housings exactly so no gaps will be visible after trims are installed.
   3. Install bottom of housing aligned with finished ceiling.
   4. Keep ceiling insulation at least 75 mm (3") away from luminaires. Exception: luminaires with insulated contact (IC) rating shall be permitted to be in contact with insulation.
   5. Install trims after painting of spaces. Install trims tightly, with no gaps or light leaks.
   6. Seismic restraints: Provide and install slack wires and hold-down clips per code.
   7. Wallwashers:
      a. Orient wallwasher housings according to manufacturer’s instructions to maximize brightness on the upper portion of the wall.

C. Ceiling-Mounted and Pendant Luminaires:

1. Provide support for outlet boxes and suspension points so luminaires can be installed securely, including seismic supports per code.
    a. Luminaire weight less than 23 kg (50 lb) at each suspension point: hang from strap or stud on outlet box, or at non-feed points, provide 1/4"-20 stud projecting 20 mm (3/4") below ceiling.
    b. Luminaire weight 23 kg (50 lb) or more at each suspension point: hang directly from structure, either independent of outlet box or from stud extending through outlet box to structure, unless the outlet box is listed for not less than the weight to be supported. Boxes used as the sole support of luminaires weighing more than 50 pounds must be listed and marked by the manufactuer with the maximum weight.
2. Pendants:
    a. Provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting.
    b. Provide diagonal seismic restraint wires above ceiling per code.
    c. Furnish suspended luminaires with universal joint type hanger canopy (and longitudinal sway adapter at each stem connection point for linear luminaires), to permit 45 degree swivel on 360 degree circle from Nadir at canopy (and 45 degree longitudinal movement at sway adapter).
    d. Luminaires over 450 mm (18") wide shall be provided with supports at all corners.
    e. Install pendants plumb and level.
    f. Verify luminaire weights and provide backing in ceiling as required.

D. Wall-Mounted Luminaires:
1. Mounting heights shown on Drawings are measured from finished floor to centerline of outlet box or recessed housing, unless otherwise noted.
2. Verify luminaire weights and provide backing in wall as required. Luminaires must not droop or tilt away from wall.
3. Wet locations: install sealant between luminaire and outlet box.
4. In circulation areas, wall-mounted luminaires must not project more than 100 mm (4") from wall if mounted above 685 mm (27") and below 2030 mm (80").

3.3 LIGHTING CONTROLS

A. Install controls so that all operable parts are at 48 inches (1220 mm) maximum height.

B. Lighting controls to include occupancy sensors in most spaces (for local control) and relay system lighting control for larger common spaces as indicated on the drawings.

C. Timeclock System shall initially be set to control the low voltage relays as per the Relay Panel Schedule LCP.
1. Assign all interior relays to an automatic off sweep, with flick warn (except those noted as "NL"). Off time shall be set to an Owner-determined time in the evening, after dark or normal business operations.
2. Off signals to may originate from BAS system, which shall be inter-connected to the Lighting Control System where indicated on the drawings.
3. Assign "after hours" and "Weekend / Holiday" hours to match normal business calendar and times.

4. All interior relays shall be allowed to be overridden by use of the local dataline switches for a maximum of 2 hours (per Title 24) when used after hours or on Weekends / Holidays. If used during these times, automatic shut-off shall re-activate at the end of the 2-hour period.
5. All interior relays shall be allowed to be overridden by use of the local dataline switches when used during normal business hours. Standard timeclock operation shall resume with the next scheduled timeclock function for each relay.
6. Assign all exterior relays for automatic on operation with the astro-dial feature, set to 30 minutes before sunset. Latitude = 37.5 degrees North / Longitude = 122 degrees West.
7. Assign exterior relays noted as "astro-on, astro-off" for automatic off operation with the astro-dial feature, set to 30 minutes after sunrise. Latitude and Longitude as noted above.
8. Assign exterior relays noted as "astro-on, timeclock-off" for automatic off operation with the normal timeclock feature, set to an owner determined time in the late evening.
9. Assign exterior relays noted as "NL" or "On All Night" for astro-dial operation, for automatic on 30 minutes before sunset and automatic off 30 minutes after sunrise.

3.4 DELIVERY, STORAGE, & HANDLING:

A. Deliver luminaires in factory-fabricated containers or wrappings, which properly protect luminaires from damage. Inspect luminaires immediately upon delivery to ensure correct shipment without damage.

B. Store luminaires in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.

C. Handle luminaires carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new. Protection wrapping on louvered (parabolic) luminaires shall not be removed until luminaires are ready for operation.

3.5 SEQUENCING AND SCHEDULING:

A. General:
   1. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of luminaires with other work.
   2. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

3.6 PROJECT CLOSEOUT

A. Clean luminaires and remove plaster and paint spatters.

B. Clean fingerprints and dust from downlight reflectors. Refer to manufacturer’s instructions.

C. Verify that luminaires and controls are working at time of final acceptance by Owner.
   1. Repair or replace lighting control devices that are inoperable.
   2. Repair or replace LED modules or entire LED luminaires that are inoperable.
   3. Repairs and/or replacements shall be at no additional cost to the Owner.

D. Test emergency lighting system for 90 minutes in presence of Owner's representative, check each luminaire for proper operation at end of 90-minute test, then recharge for 24 hours and briefly test each luminaire again for proper operation.

E. Install and aim adjustable lighting as directed by Architect.
   1. Provide personnel, lifts, ladders, and walkie-talkies as required.
   2. Aiming will occur at night, outside of normal working hours, at times as approved by the Architect.

F. Prepare two copies of a Lighting Systems Maintenance Manual consisting of the following in a hardcover binder. Deliver to Architect. After review, Architect will deliver one copy to Owner.
   1. One complete set of approved submittals, including product data and shop drawings.
   2. Luminaire cleaning instructions, including chemicals to be used or avoided.
   3. Instructions for code-required testing and maintenance of emergency lighting system.

END OF SECTION

SECTION 26 56 01

SITE LIGHTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Luminaires

B. LEDs

C. Power Supplies/Drivers

D. Poles

E. Pole bases

F. Controls and wiring

1.2 SYSTEM DESCRIPTION

A. Furnish all labor, materials, apparatus, tools, equipment transportation, temporary construction and special or occasional services as indicated on the Drawings or described in these Specifications and as required to make a complete working site lighting system.

B. Illumination levels shall be in accordance with recommendations by the Illuminating Engineering Society (IES).

1.3 INCORPORATED DOCUMENTS

A. Section 26 05 00 and Section 26 51 01 apply to all work in this Section.

1.4 SUBMITTALS

A. Catalog Information:
   1. Luminaire (each type) with photometric pattern.
   2. Poles.

B. Shop Drawings.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Provide new materials and equipment unless otherwise specifically indicated or specified. Materials shall be listed by Underwriter's laboratories, Inc. (U.L.) and bear evidence of such approval where applicable.

B. Luminaires: Site luminaires shall be weatherproof. Reflectors and refractors shall provide the light configuration indicated and conforming to IES recommendations.

C. Luminaires and poles shall be finished in epoxy enamel designed to withstand the effects of salt spray. Lens shall be securely attached to the lens frame for security during maintenance and relamping.

D. Poles, Brackets, Pole Bases and Attachments: Shall be rated for service with wind velocities of 100 mph considering the force exerted by the wind on the maximum exposure of the fixture luminaire selected.

E. Poles shall be anchor base type round, height and style as indicated, finished to match luminaire, complete with handhole and gasketed cover, anchor bolts with leveling and locking screws, grounding connection, and matching base cover.

F. Concrete pole bases shall be cast-in-place reinforced concrete as indicated with anchor bolts and conduit entries as per manufacturer. Concrete shall be rated 3,000 PSI at 28 day test.

G. Concrete:
   1. Concrete for electrical requirements shall be at least 3,000 psi concrete with 1-inch maximum aggregate conforming to the requirements of Division 3 for Cast-In-Place concrete.

2.2 SOLID STATE LUMINAIRES

A. Housing, where applicable:
   1. Steel bonderized or equal rust protected, or aluminum, rigid construction. Minimum gauge thickness shall be as follows:
      a. Interior locations: No. 20-gauge steel, No. 16-gauge aluminum.

B. Finish:
   1. Baked enamel finish (except when otherwise specified).
      a. Concealed interior surfaces (this applies to interior hardware, circuit boards, etc.) matte black.
      b. Concealed exterior surfaces: matte black.
      c. Visible surfaces: color and texture as specified below for each luminaire type or as selected.
      d. Exterior luminaire finish: refer to Luminaire Schedule.

C. Light Emitting Diode (LED) requirements:
   1. Correlated color temperature (CCT) for phosphor-coated white LEDs must have one of the following designated CCT's and fall within the following binning standards.
      a. 3000K defined as 3045 +/- 175K
   2. Color spatial uniformity shall be limited to variations in chromaticity for different directions (i.e. changes in viewing angle) within 0.004 from the weighted average point on the CIE 1976 (u',v') diagram.
   3. Color maintenance shall be limited to a maximum change in chromaticity of 0.007 on the CIE 1976 (u',v') diagram over the lifetime of the product.

a. Color rendering index: Color rendering index to be determined using ANSI C78.377-2008 and applicable IESNA standards.
b. Laboratory tests must be produced using specific module(s)/array(s) and power supply combination that will be used in production.
c. Manufacturers must provide a test report from a laboratory accredited by NVLAP or one of its MRA signatories

4. Lumen depreciation
   a. Lumen depreciation to be measured using IESNA LM-80-08 standard for IES approved method of measuring lumen maintenance of LED light sources.
   b. Phosphor coated white LED module(s)/array(s) shall deliver at least 70% of initial lumens for a minimum of 50,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
   c. Colored LED module(s)/array(s) shall deliver at least 50% of initial lumens for a minimum of 50,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
5. Acceptable LED manufacturers:
   a. Cree
   b. Nichia
   c. Osram Opto Semiconductors
   d. Philips Lumileds

D. Luminaire Efficacy:
1. Luminaire efficiency shall be measured using IESNA LM-79-08 standard for electrical and photometric measurements of solid state lighting products.
2. Manufacturer shall provide published luminaire efficacy, which is defined as luminaire light output divided by luminaire input power measured in a 25 degree Celsius environment. Efficacy shall include power supply, thermal, optical, and luminaire losses.

E. Thermal Management:
1. Solid state luminaire shall not exceed LED manufacturer's maximum junction temperature requirements when operated in-situ at luminaire manufacturer's maximum ambient operating temperature and 100% light output.
2. Solid state luminaires shall be thermally protected using one of more of the following thermal management techniques:
   a. Metal core board
   b. Gap pad
   c. Internal monitoring firmware
3. Solid state luminaire housing shall be designed to transfer heat from the LED board to the outside environment.

F. Power Supply/Driver requirements:
1. Power factor of 0.90 or greater for primary application
2. Input current shall have Total Harmonic Distortion (THD) of less than 20%.
3. Minimum operating temperature of minus 20 degrees Celsius or below when used in luminaires intended for outdoor applications.
4. Output operating frequency to be equal to or greater than 120 Hz.
5. Operate with sustained input variations of +/- 10% (voltage and frequency) with no damage to the driver.
6. Tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.

7. Output shall be regulated to +/- 5% across published load range.
8. Class A sound rating.
9. Outputs shall have current limiting protection.
10. Operate LEDs at constant and regulated current levels. LEDs shall not be overdriven beyond the diode manufacturer's specified nominal voltage and current.
11. Inrush currents not exceeding peak currents specified in NEMA 410.

G. Solid State Lighting Controls:
   1. Control interface to dimmable power supplies shall consist of one of the following:
      a. Line Voltage Dimming. Controls to be rated for magnetic or electronic low voltage transformer operation.
      b. Low voltage (0-10V) control. Controls to be compatible with either current sink or current source operation.

H. System Installation
   1. Hardwired connections to solid state luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
   2. All solid state luminaires (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing. Solid state lighting installations shall be UL Listed as a low-voltage lighting system including, but not limited to, luminaire, power supply, controller, keypad, and wiring.

I. Warranty
   1. Luminaires, drivers, and controllers for solid state lighting systems shall be covered by a minimum five-year warranty against defects in workmanship or material. Warranty shall include in-warranty service program providing for payment of authorized labor charges incurred in replacement of inoperative in-warranty equipment.

2.3 LUMINAIRE CONSTRUCTION

A. Sheet metal: materials and thicknesses shall be 20 gauge (0.7 mm or 0.027") min., free of dents, scratches, oil-can, or other defects.

B. Painted luminaires: exposed weld marks, joints, and seams shall be filled and sanded smooth before finishing.

C. All edges cleaned and dressed to remove sharp edges or burrs.

D. Extrusions: 1/10" min. wall thickness, smooth and free of tooling lines, with cast end plates that exactly match extrusion profiles.

E. Castings: smooth, free of pits, scales, gate marks, or blemishes.

F. Spinnings shall have 1/32" min. thickness, smooth, free of spinning lines or blow-back, with clean edges.

G. Welds: Follow recommendations of American Welding Society. All welds continuous and free of spatter, residue, or warping.

H. No light leaks visible. Field paint exterior of housing with high temperature paint if necessary.

I. Exposed end plates and joiners, with concealed fasteners.

J. Hardware:
   1. Steel or aluminum exterior luminaires: stainless steel hardware.
   2. Stainless steel luminaires: stainless steel hardware.
   3. Copper alloy luminaires: brass hardware.

K. Raceways: Where used for through wiring, luminaires must be approved for use as raceways.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Refer to Section 26 27 00, Part 2.2, for wiring and splicing requirements.

B. Underground cable installation shall conform to National Electrical Code except as otherwise specified or indicated.

C. Contractor Damage: The Contractor shall promptly cause repairs to be made to any indicated utility lines or systems damaged by his operation.

D. Under roads and paved areas, ducts shall be EPC-80-PVC polyvinyl chloride conduit.

E. Cables shall be in one piece without splices between connections except where the distance exceeds the lengths in which the cable is furnished.

F. Bends in cables shall have an inner radius of not less than 12 times the cable diameter.

G. Horizontal slack of approximately 3 feet shall be left in the ground on each end of cable runs, on each side of connection and at all points where connections are to be made above ground level.

H. Earthwork: Earthwork for electrical requirements shall conform to the requirements of Division 31.

I. Coordinate work with other trades. Pre-ship anchor bolts and templates for use in preparing bases for installation. After leveling luminaires, pack grout between mounting plate and concrete footing. Provide weep holes to prevent accumulation of moisture inside pole base.

3.2 TESTS

A. Test under provisions of Division 1, Section 26 08 00, and Section 26 51 01.

B. The Owner shall be notified at least three working days in advance of the Contractor's proposed date of the tests to permit scheduling, and to permit witnessing of the tests. The Contractor shall furnish the Owner with three copies of the results of the tests.

C. Circuits: The Contractor shall test each circuit, all controllers, and components of the system for proper operation. The Contractor shall furnish the Owner with three copies of the test results.

D. Compaction Tests: Backfill shall be tested for compaction in accordance with ASTM D1556.

E. Operating Test: Contractor shall operate the system in the presence of the Owner proving the proper operation.

END OF SECTION

SECTION 26 57 00

LOW VOLTAGE LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Furnish all labor, materials, apparatus, tools, equipment transportation, temporary construction and commissioning services as indicated on the Drawings or described in these Specifications and as required to make a complete working facility lighting control system.

B. Integrated Low Voltage Lighting Control System:
   1. The low voltage lighting control system shall consist of switches, digital occupancy sensors, daylighting sensors, room controllers, relay panels and LMCS system configuration software.
   2. The system shall accept program changes from the LMCS system configuration software for date and time, location, holidays, event scheduling, button binding and group programming.

C. Requirements are indicated in Section 26 27 00 for raceways and electrical boxes and fittings required for installation of control equipment and wiring.

D. Provide CBC 2022 compliant seismic installation. See Section 26 05 00 for all certification and submittal requirements.

1.2 INCORPORATED DOCUMENTS

A. Sections 26 05 00, 26 27 00, 26 51 01 and 26 56 01 apply to all Work in this Section.

B. Integrated Automation Control of HVAC- Integrated Automation. Building integrator shall provide integration of the lighting control system with Building Automation Systems.

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

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Manufacturers: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

C. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

D. Installer Qualifications: Installer shall be one who is experienced in performing the Work of this Section, and who has specialized in installation of Work similar to that required for this project.

E. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

F. Component Pre-testing: All components and assemblies are to be factory pre-tested prior to installation.

G. System Support: Factory applications engineers shall be available for telephone support.

H. NEC Compliance: Comply with NEC as applicable to electrical wiring Work.

I. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

J. UL Approvals: Remote panels are to be UL listed under UL 916 Energy Management Equipment and/or UL 508 Industrial Control Equipment.

K. CSA Approvals: Remote panels are to be CSA listed.

L. FCC Emissions: All assemblies are to be in compliance with FCC emissions Standards specified in Part 15 Subpart J for commercial and residential application.

M. All System components shall be California Title 24 compliant, where applicable.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 and 26 05 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   3. Storage and handling requirements and recommendations.
   4. Installation instructions.

C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
   3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.

4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
   1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
   2. Operation and Maintenance Manual:
      a. Include approved Shop Drawings and Product Data.
      b. Include Sequence of Operation, identifying operation for each room or space.
      c. Include manufacturer's maintenance information.
      d. Operation and Maintenance Data: Include detailed information on device programming and setup.
      e. Include startup and test reports.

F. Submit under provisions of Sections 01 33 00 and 26 05 00.
   1. Bill of Materials: Complete list of all parts needed to fully install selected System components.
   2. Shop Drawings: Submit dimensional Drawings of all lighting control system components and accessories.
   3. One Line Diagram: Submit a one-line diagram of the system configuration.
   4. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, relay panels, relays, room controllers, digital low voltage switches, digital occupancy sensors, digital daylighting controls, and border routers.

1.5 MANUFACTURERS

A. Integrated Low Voltage Lighting Control System:
   1. The basis of the specified system is the Watt Stopper Digital Lighting Management (DLM) or an equal. Any other system to be considered must submit descriptive information 10 days prior to bid.

B. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the engineer.

C. The Owner reserves the right to reject a proposed substitution based on his agent’s professional judgment as to the utility, visual appropriateness, or finish of substitutions.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Storage and Protection: Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.7 GUARANTEE AND WARRANTIES

A. All Work performed under this Section must be guaranteed to be free of defects in products or workmanship for one year after date of acceptance by Owner, unless noted otherwise in General Conditions.

B. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 - PRODUCTS

2.1 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
   1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   2. Wireless Network Bridge and Border Router: Provides Wireless Network Bridges that automatically create BACnet objects for all DLM devices on their local network (room) and communicate that information over a standalone wireless mesh 6LoWPAN network to a Border Router. The Border Router manages the formation and communication of the mesh network, and provides an ethernet network connection to upstream intelligent devices, such as a Segment Manager.
   3. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

B. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
   1. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
   2. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

C. Description
   1. Lighting Control System shall include Dimming / Switching Room Controllers, Digital Occupancy Sensors, Digital Daylight Sensors, Digital Dimmers / Switches, Network Components and Relay Panels. All project shall be UL listed and consist of the following:

2. Lighting Control Panel Enclosure Tub: NEMA 1, NEMA 3R, or NEMA 4 as indicated on the drawings, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors.
3. Cover: Surface or Flush as required, hinged and lockable and with restricted access to line voltage section. A final typed wiring schedule directory card shall be affixed to the cover's back.
4. Interior: Barrier included for separation of high voltage (class 1) and low voltage (class 2) wiring. The interior shall include intelligence boards, power supply, mechanically latched control relays and multi-pole contactors. The interiors will include the following features:
    a. Screwless, removable, plug-in connections for all low voltage terminations.
    b. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches, digital occupancy sensors and digital daylight sensors.
    c. Each relay shall be capable of individual ON/OFF control by a low voltage switch and / or occupancy sensor input.
    d. The system shall monitor true relay status; the relay status will be displayed at the onboard pilot LED and monitored by the system electronics.
    e. Stagger the On and OFF sequence of the relays.
    f. Heavy Duty Relays - Mechanically latching contacts with single moving part design for improved reliability. Relays to have the following characteristics:
    g. 30 amp NEMA 410 electronic ballast rated and 20 amp tungsten, rated for 50,000 ON/OFF cycles at full load. Support #12-#14 AWG solid or stranded wire and rated for 120 and 277 volts; 20 amp NEMA 410 electronic ballast rated and 20 amp tungsten 347 volts.
        1) 30 VAC isolated contacts for status feedback and pilot light indication.
        2) 14,000 amp short circuit current rating.
        3) Contactors shall be DIN rail mounted, four pole standard, normally open or normally closed, electrically held with 120 or 277 volt coil voltage to match panel control power voltage. Contractors shall be compatible with all lighting, ballast and HID loads and be rated for 277 volt 20 amp tungsten and 600 volt 30 amp ballast loads.
    h. Power Supply: Multi-voltage transformer assembly with enough power to supply all electronics, occupancy sensors, dataline switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
    i. Multiple panels may be networked together for global control. The LMCP panels shall be networked together over a MS/TP 3-conductor connection.

2.2 GROUP, CHANNEL, SCHEDULE AND PATTERN CONTROL

A. Description
1. The lighting control panel shall support schedule, group, and photocell control functions via the network as configured using the LMCS Configuration Software.
2. Group Status: Each group pushbutton shall include an LED status indication. The LED will be ON whenever all of the relays within the group are ON; and shall go OFF when all of the relays within the group go OFF. The LED will be green when

in a “mixed” state. Each channel shall also have an associated dry contact closure and pilot contact which tracks the LED operation described above.

B. Features
1. Individual relays may be assigned to more than one channel, and the channel status will be annunciated appropriately.
2. Each channel shall also have an input for connecting switch or dry contacts for controlling a channel. Inputs shall accept 2 or 3-wire maintained or momentary inputs, and groups may be controlled by: an on-board group pushbutton switch, low voltage switch, digital switch, digital occupancy sensor, digital photocell, or time of day.
3. Screwless, removable, plug-in terminals will be provided for all low voltage wiring connections.

2.3 NETWORK CLOCK

A. Description

B. Provide an integral network clock that connects to the system using the digital Wireless Network Bridges, connected to a DLM local network (room) and use IEEE 802.15.4 6LoWPAN for communication between rooms and to a Border Router that oversees the formation and configuration of the wireless network. Each local network shall include a wireless network bridge that connects to the other DLM devices on the local network, and a group of Wireless Bridges shall connect to a Border Router.
1. The clock will be used to schedule any of the eight global channel groups (Section 2.03) in the relay panel network. The clock will support all of the energy saving features required of ASHRAE 90.1 - 2001, IECC 2003, as well as all state and local energy codes.
2. The clock will provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and EEPROM for program retention. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
3. The clock shall allow unique scenario and time delays. Scenarios are:
   a. Scheduled ON / OFF
   b. Manual ON / Scheduled OFF
   c. Manual ON / Auto Sweep OFF (for AS-100 Switches)
   d. Astro ON / OFF (or Photo ON / OFF)
   e. Astro and Schedule ON / OFF (for Photo and Schedule ON / OFF)

C. Features
1. Runs event-based schedule routines independently (does not require BAS or Segment Manager).
2. Supports astronomical, time-based event types
3. Retains memory and time for a minimum of 10 years.

2.4 DIGITAL SWITCHES / DIMMERS

A. Description

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED indicator light on each switch that blinks to indicate data transmission.
4. Load/Scene Status LED indicator light on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
7. Two RJ-45 ports for connection to DLM local network.
8. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
9. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screwless Lexan wall plate.
10. Individual buttons shall be custom engraved with a maximum of 15 characters (including spaces) on two lines, where shown on plans.
11. Multiple digital switches wired to control the same relay or relay group shall indicate the same status automatically.

B. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101.

C. Description
   1. Intelligent digital switching shall be operating on the DLM Category 5e local network. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. All devices shall mount in a standard single-gang box
   2. Each button in a switch can be individually programmed. Programming is done by the LMCT-100 handheld configuration tool. Each button can control any one of the following options:
      a. Any individual relay in any single panel.
      b. Any group of relays in any single panel.
      c. Any group of relays in the system.

D. Features
   1. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
   2. Switches can be configured to follow a “Cleaning” scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays turned ON by the occupant.

2.5 DIGITAL OCCUPANCY SENSORS

A. Description
   1. Digital Occupancy Sensors - Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

2.6 DIGITAL PHOTOSENSORS

A. Description
   1. Digital Photosensors - Single-zone closed loop, multi-zone open loop and dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.

2.7 DIGITAL DIMMING / SWITCHING ROOM CONTROLLERS

A. Description
   1. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features.
   2. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
   3. Simple replacement - Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
   4. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest.
   5. Device Status LEDs to indicate:
      a. Data transmission
      b. Device has power
      c. Status for each load
      d. Configuration status
      e. Quick installation features including:
         1) Standard junction box mounting
         2) Quick low voltage connections using standard RJ-45 patch cable
      f. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
         1) Turn on to 100%
         2) Remain off
         3) Turn on to last level

g. Each load shall be configurable to operate in the following sequences based on occupancy:
   1) Auto-on/Auto-off (Follow on and off)
   2) Manual-on/Auto-off (Follow off only)
h. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
i. BACnet object information shall be available for the following objects:
   1) Load status
   2) Electrical current
   3) Total watts per controller
   4) Schedule state - normal or after-hours
   5) Demand response control and cap level
   6) Room occupancy status
   7) Total room lighting and plug loads watts
   8) Total room watts/sq ft
   9) Force on/off all loads
j. UL 2043 plenum rated
k. Manual override and LED indication for each load
l. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
m. Zero cross circuitry for each load
n. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

B. On/Off Room Controllers shall include:
   1. One or two relay configuration
   2. Efficient 150 mA switching power supply
   3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
   4. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/Dimming enhanced Room Controllers shall include:
   1. Real time current monitoring
   2. Multiple relay configurations
      a. One, two or three relays (LMRC-21x series)
      b. One or two relays (LMRC-22x series)
      c. Efficient 250 mA switching power supply
      d. Four RJ-45 DLM local network ports with integral strain relief and dust cover
      e. One dimming output per relay
         1) 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
         2) Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of

compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)

3) Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
4) The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
5) Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
6) Calibration and trim levels must be set per output channel.
7) Devices that set calibration or trim levels per controller are not acceptable.
8) All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

f. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
g. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
h. The following dimming attributes may be changed or selected using a wireless configuration tool:
1) Establish preset level for each load from 0-100%
2) Set high and low trim for each load
3) Set lamp burn in time for each load up to 100 hours
i. Override button for each load provides the following functions:
1) Press and release for on/off control
2) Press and hold for dimming control
j. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC-221, LMRC-222

D. Plug Load Room Controllers shall include:
1. One relay configuration with additional connection for unswitched load
2. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
3. Factory default operation is Auto-on/Auto-off, based on occupancy
4. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
5. Efficient switching power supply
a. 150mA (LMPL-101)
b. 250mA (LMPL-201)
c. RJ-45 DLM local network ports
1) Three RJ-45 ports (LMPL-101)
2) Four RJ-45 ports (LMPL-201)

d. WattStopper product numbers: LMPL-101, LMPL-201.

2.8 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:
   1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
   2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
   3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:
      a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
      b. Individual terminal block, override pushbutton, and LED status light for each relay.
      c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
      d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
      e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
      f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
      g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
      h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
   4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
      a. Electrical:
         1) 30 amp ballast at 277V

2) 20 amp ballast at 347V
3) 20amp tungsten at 120V
4) 30 amp resistive at 347V
5) 1.5 HP motor at 120V
6) 14,000 amp short circuit current rating (SCCR) at 347V
7) Relays shall be specifically UL 20 listed for control of plug-loads

b. Mechanical:
1) Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
4) Tested to 300,000 mechanical on/off cycles.

5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 tnetworked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
1) Scheduled ON / OFF
2) Manual ON / Scheduled OFF
3) Astro ON / OFF (or Photo ON / OFF)
4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)

f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
    a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
    b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
    c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
    d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
    e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
    f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
        1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
        2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
        3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
        4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)
i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
    a. Use the same intelligence board as the LMCP relay panel.
    b. Shall not include relay driver boards or relays.
    c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
    d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
    e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

2.9 CONFIGURATION TOOLS

A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
    1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
    2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

3. Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.
4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.10 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

B. Additional parameters exposed through this method include but are not limited to:
1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1. Device list report: All devices in a project listed by type.

2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
7. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
1. Set, copy/paste an entire project site of sensor time delays.
2. Set, copy/paste an entire project site of sensor sensitivity settings.
3. Search based on room name and text labels.
4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
5. Filter by parameter value to search for product with specific configurations.

E. Network-wide firmware upgrading remotely via the BACnet/IP network.
1. Mass firmware update of entire rooms.
2. Mass firmware update of specifically selected rooms or areas.
3. Mass firmware upgrade of specific products.

F. WattStopper Product Number: LMCS-100, LMCI-100

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PRE-INSTALLATION MEETING

A. Manufacturer shall provide a factory authorized representative to provide a functional overview of the lighting control system prior to products being installed.
1. Discuss functionality and integration of all products per design requirements.
2. Confirm location of occupancy sensors and photocells as required.
3. Confirm low voltage control wires meet specification.
4. Explain adjustment options and verify specification requirements for each device.

B. Convene meeting two weeks prior to commencing work of this section to coordinate integration of lighting control system to building management system. Meeting to be

attended by electrical contractor, mechanical contractor, general contractor, system installer if not electrical contractor, factory authorized representative and IT manager from facility.

1. Review integration requirements in this section of specification
2. Confirm responsibilities of network terminations for electrical and mechanical system
3. Review information to be exchanged between system and delivery method of data
4. Identify scope of the integration including but not limited to the following use cases:
    a. Scheduling
    b. Demand Response
    c. Normal hours vs. after hours adjustments of device parameters
    d. Identify points in export table to monitor and control
        1) Occupancy State
        2) Power usage in room
        3) Daylight status/footcandle level

C. All programming, labeling and training for exterior lighting timeclocks to be provided by the BMS system integrator.

3.3 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install no wireless devices within 10’-0” radius of the border router, including Wattstopper wireless network bridges and third-party devices such as wi-fi access points, security systems, RFID tagging equipment, etc. Coordinate this requirement with the general contractor and all trades.

C. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.

1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
4. Low voltage wiring topology must comply with manufacturer's specifications.
5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

D. All line voltage connections shall be tagged to indicate circuit and switched legs.

E. Test all devices to ensure proper communication.

F. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

G. 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.)

H. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

I. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

J. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

K. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

L. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

M. Lighting Control Relay Panels:
   1. Digital Switches and/or photocells shall be mounted in the spaces as indicated on the Drawings. Each low voltage wire shall be labeled clearly indicating which relay panel it connects to. All relays and switches shall be tested after installation to confirm proper operation and the loads recorded on the directory card in each panel.
   2. The relay panels shall be mounted in electrical closets as indicated on the Drawings. The numbered relays in the panel shall be wired to control the power to each load as indicated on the Panel Wiring Schedules included in the Drawings. All power wiring shall be identified with the circuit breaker number controlling the load. If multiple circuit breaker panels are feeding into a relay panel, wires shall clearly indicate the originating panel’s designation.

3.4 PROGRAMMING

A. Perform the following inspections and prepare reports.
   1. Verify Class I and II wiring connections are terminated properly by validating system performance.
   2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
   3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
   4. Verify that the control of each space complies with the Sequence of Operation.
   5. Correct any system issues and retest..

3.5 SYSTEM STARTUP

A. The Manufacturer shall provide a factory authorized technician to commission and confirm proper installation and operation of all system components.

B. Contractor shall provide system documentation after the equipment has been installed:
   1. Lighting control operational summary sheet.
   2. Programming record sheet.
   3. System Installation and Operation Manual shall be provided to the owner.

3.6 TRAINING

A. Manufacturer shall provide factory authorized application engineer to train Owner personnel in the operation and programming of the lighting control system for the first day of occupancy; then (1) one month later.

3.7 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

3.8 TESTS

A. Test under provisions of Section 26 05 00 and 26 08 00.

B. The Owner shall be notified at least three working days in advance of the Contractor's proposed date of the tests to permit scheduling, and to permit witnessing of the tests. The Contractor shall furnish the Owner with three copies of the results of the tests.

C. Circuits: The Contractor shall test each circuit, all controllers, and components of the system for proper operation. The Contractor shall furnish the Owner with three copies of the test results.

D. Operating Test: Contractor shall operate the system in the presence of the Owner proving the proper operation of the system and all components.

END OF SECTION

SECTION 27 00 00

TELECOMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This project includes the provisions for and installation of a complete telecommunications system pathways and wiring infrastructure system for the modernized and expanded facility, including all terminations, testing, and all related passive components required for operation.

1.2 WORK INCLUDED

A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to install the work as shown on the drawings and as specified hereinafter, including, but not limited to the work listed below.

B. Provide and install complete and functional data communication system (voice services via VOIP), including all necessary passive components, to allow full operation of the wiring infrastructure system upon completion.

C. The installation shall include all optical fiber, twisted pair copper, inner-duct, conduit, fiber interconnect / patching equipment, copper interconnect / patching equipment, fiber connectors, copper connectors, splices, fiber patch cords / jumpers, copper patch cords / jumpers, wiring blocks, data outlets, wi-fi access points, and any other equipment specified herein.

D. The installation shall <u>not</u> include any active network components such as routers, switches, hubs, fiber optic transceivers, wireless communications system transceivers, antennae, base stations and concentrators or servers, which shall be supplied by the owner.

E. Upon completion of the installation, this contractor shall test all fiber and copper pathways and record the test results as specified herein. Test results must be delivered to the owner upon completion of project

F. The scope of work under this Section shall include any other work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

G. Provide CBC compliant seismic installation. See Section 260500 for all certification and submittal requirements.

1.3 RELATED WORK

A. Division 1 – General Requirements.

B. Division 9 – Finishes.

C. Section 260500 – Basic Electrical Requirements

D. Section 262700 - Basic Electrical Materials & Methods

E. Equipment and work provided by the owner's network integrator, including owner provided network servers, switches, hubs, optical fiber transceivers, routers, wireless communication system equipment, etc.

1.4 INCORPORATED DOCUMENTS

A. Requirements of the General Conditions, supplementary conditions, and Division 1 Sections apply to the work of this section, unless modified herein.

B. Published specifications, standard tests or recommended methods of trade, industry or government organizations shall apply to work of this section where cited by abbreviations noted below, unless modified herein.

1. National Electrical Code, latest edition, (NEC), Article 800-4.

2. Underwriters' Laboratories, Inc. (UL), UL 1459, UL 1863.

3. ANSI/TIA-568.1-D "Commercial Building Communications Cabling Standard"

4. ANSI/TIA-568.3-D "Optical Fiber Cabling and Components Standard"

5. ANSI/TIA-568.3-D "Optical Fiber Cabling and Components Standard"

6. ANSI/TIA-569-D "Telecommunications Pathways and Spaces"

7. ANSI/TIA-568-C.2-1. "Balanced Twisted-Pair Telecommunications Cabling and Components Standard".

8. IEEE 802.3 "Carrier Sense Multiple Access With Collision Detection".

9. IEEE 802.11b "Wireless Network standard"

10. Owner's telecommunications Standards and Requirements.

1.5 CONTRACTOR QUALIFICATIONS

A. Contractor must possess a valid state Contractor's License and must have successfully performed at least five projects of similar scope, within two years of the date of this bid. Proof of performance shall be in the form of reference sheets, which shall include a brief description of the project, the beginning and ending contract price, the project foreman or superintendent's name, and the name, address, and telephone number of a project contact.

B. Contractor must be able to prove to the satisfaction of Owner that it has significant experience in the installation of optical fiber cable systems. Installation must include installation of optical fiber cable, fiber termination, knowledge of interconnect equipment, and a thorough knowledge of testing procedures. Contractor must provide a minimum of three references supporting its claim of experience for similar projects within the two years prior to this bid. Documentation must be included with the bid documents submitted.

C. Contractor must have been in business and in the business of installing telecommunications systems, continuously, for a period of at least three years, prior to the date of this bid.

D. Contractor must have an RCDD on staff.

1.6 SUBMITTALS

A. General: Comply with the requirements of Section 260500 – Submittals.

B. Submit complete list of all items of materials to be furnished, and installed to the owner for compliance review prior to purchasing the materials. Submittals shall include:

1. Complete bill of materials and equipment, including a complete listing of the characteristics of the equipment as specified.

2. One line diagram indicating all system connections, all closet locations, rack arrangements, cabinets, and workstation outlets.

3. Rack and communications cabinet layouts and dimensions.

4. Samples of proposed cable markers and labeling, and patch panel labeling and color-coding.

5. List of instrumentation to be used for system testing, including certificate of manufacturer's calibration.

6. ¼ scale plan of all telecommunications rooms and closets, indicating proposed layout of all equipment and cable trays, troughs, and runways.

7. Manufacturer's warranty application for the indicated project.

8. Schedule of work completion coordinated with the General Contractor.

C. Submit Contractor's qualifications as outlined in Section 1.5 above.

D. Submit "as-built" record drawings at the completion of the installation and testing.

E. The Contractor shall submit all testing documentation prior to acceptance of the work by the Owner.

F. Contractor shall submit to the Owner, in writing, 48 hours advance notice when testing of optical fiber cable will begin.

1.7 GENERAL REQUIREMENTS

A. The telecom communications system shall consist of three components:

1. An optical fiber backbone.

2. Twisted pair copper workstation cabling.

3. Twisted pair copper cabling for wireless access points.

B. The building shall be connected via a single cable, multi-strand single mode optical fiber cable from the Campus Main Distribution Frame (MDF) to the Building Distribution Frame (BDF)..

C. All optical fiber cables shall be enclosed in innerduct installed in conduit.

D. All copper backbone cables shall be routed along with the fiber cable, shall originate at the MDF, and shall terminate in their respective IDF/BDF.

E. From each IDF/BDF, one or more twisted-pair copper cables shall be routed to each data outlet location, (and two cables to each wireless antenna location), as indicated on the drawings.

1. The wiring system shall be provided and installed per TIA / EIA-568 wiring topology and shall be Category 6A rated.

2. Unshielded twisted pair (UTP) cable, installed for high-speed data application, shall not exceed 295 feet in length between terminations.

F. Terminations:

1. All fiber strands shall be terminated with connectors and land on fiber interconnect equipment.

2. All data cables and wireless communications cables shall be terminated on modular patch panels.

3. All active equipment will be provided and installed by the owner.

G. The BDF will also house active data distribution equipment provided by the owner, possibly including but not limited to local area network hubs and switches, optical fiber transceivers, wireless communication systems base stations and concentrations routers, and servers. This Contractor shall coordinate with Owner's network integrator to ensure that data rack and cabinet layouts fully accommodate all owner-provided equipment.

1.8 FUNCTION AND OPERATION

A. The function of the data communications cable system is to transmit data signals from a central location to multiple individual data outlet locations. Upon completion of the work outlined in this specification, the entire cable system, including cable, and communications outlets shall be tested to (and meet) Category 6A compliance.

1. Horizontal UTP Category 6A 23AWG copper cabling system shall be guaranteed to exceed all TIA-568-C.2 link and channel performance requirements and be capable of supporting 10G Base-T (802.3an) and ISO/IEC 11801 Class EA applications for a total distance of 100 meters with equipment cords. System shall be guaranteed to meet all Cat 6A requirements for short links and channels down to a 10 foot link (5 meter channel) with a guaranteed 4 dB margin of Alien Crosstalk.

2. Basis of Design is Berk-Tek Leviton Technologies CS6700 CAT6A Shielded System.

B. Upon completion of the work, the singlemode optical fiber cable system shall be capable of transmitting signals with a bandwidth of up to 500 MHz at both 1310 and 1550 nm. The cumulative signal loss, through connectors, jumpers, couplers, and fiber cable, shall be less than 10dB.

1.9 GUARANTEE

A. The Cabling System shall meet the performance requirements of the ANSI/TIA/EIA-568-C.2 standard. The warranty on the material, services, and operation of the cabling system to this specification must be for a period of at least 15 years. The connecting hardware shall have a lifetime extended warranty against defects in material and workmanship.

B. The warranty must include the following statements regarding the cabling system:

1. "Will support and conform to TIA/EIA-568-C.2 specifications covering any current or future application which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel and/or basic link performance as described in TIA/EIA-568-C".

2. "Will be free from defects in material or faulty workmanship for the entire warranty period".

C. The Contractor shall apply for a warranty from the manufacturer within 60 days from end of project. In order to achieve a warranty the contractor must be in good standing with current training records on file.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS. First named manufacturer is the Basis of Design U.O.N,

A. Copper & Fiber Cable

BerkTek, Superior Essex, Avaya, Siecor, or equal

B. Fiber Optic Distribution Panels and Interconnects

Leviton, ADC Telecommunications, Siecor, or equal

C. Copper Patch Panels and Devices

Ortronics, Leviton, Avaya, Chatsworth, Siemon, or equal

D. Cabinets and Racks

Chatsworth, ESW (Encore), Leviton, Homaco, Ortronics, or equal

E. Innerduct

Eastern, Endot, or equal

F. Firestopping

STI (Specified Technologies, Inc.), 3M, or equal

G. Steel Wire Cable Tray:

Cablofil, Mono-Mesh, GS Metals, or equal

H. Cable Runway:

Chatsworth, Cablofil, B-Line, Mono-System Inc, or equal

I. Fiber Optic Cable Trough:

Ortronics, ADC Telecommunications, or equal

2.2 SYSTEM PERFORMANCE

A. Category 6A (CAT6A) Unshielded Twisted Pair (UTP) Systems

1. Category 6A 23AWG UTP copper cabling system shall be guaranteed to exceed all TIA-568 link and channel performance requirements and be capable of supporting 10G Base-T (802.3an) and ISO/IEC 11801 Class EA applications for a total distance of 100 meters with equipment cords. System shall be guaranteed to meet all CAT6A requirements for short links and channels down to a 10 foot link (5 meter channel) with a guaranteed 5 dB margin of Alien Crosstalk.

2. Basis of Design is Berk-Tek Leviton Technologies CX6850 Cat6A Premium UTP System, or approved equal.

3. Category 6A Performance Parameters, headroom over TIA-568 standard:

Insertion	NEXT	PSNEX	ACR-F (ELFEX	PSACR-F	Return Loss	ACR-N	PSACR-	PSANE	PSAACR
3	5 dB	6 dB	10 dB	10 dB	4 dB	7 dB	7 dB	5 dB	11 dB

B. CAT6A Unshielded (U/UTP, or UTP) Systems

1. Horizontal UTP Category 6A 23AWG copper cabling system shall be guaranteed to exceed all TIA-568-C.2 link and channel performance requirements and be capable of supporting 10G Base-T (802.3an) and ISO/IEC 11801 Class EA applications for a total distance of 100 meters with equipment cords. System shall be guaranteed to meet all Cat 6A requirements for short links and channels down to a 10 foot link (5 meter channel) with a guaranteed 4 dB margin of Alien Crosstalk.

2. Basis of Design is Berk-Tek Leviton Technologies CS6700 CAT6A Shielded System, or approved equal.

3. CAT6A Performance Parameters, headroom over TIA-568-C standard:

Insertion	NEXT	PSNEXT	ACR-F (ELFEXT)	PSACR-F	Return Loss	ACR-N	PSACR-N	PSANEXT	PSAACRF
3	4 dB	6 dB	8 dB	8 dB	3 dB	7 dB	8 dB	16 dB	16 dB

C. Connectors

1. Provide mission-critical, modular-type, information connectors/outlets (jacks) for 24-23 AWG copper cable as noted on the drawings. These connectors shall be individual snap-in style, and exceed compliance with TIA-568 specifications. The connectors shall comply with the following:

   a. Shall be 8-position 8-conductor (8P8C) "RJ45"-style modular jack, Category 6 (CAT6) and Category 6A (CAT6A), with IDC terminals, T568A/B wiring scheme (use T568B), and utilize a non-punchdown simplified manual termination style.
   b. Shall be encased in a die-cast housing to protect from potential EMI/RFI, and utilize a universal Keystone-style insertion footprint as the manufacturer's main "flagship" line of products.
   c. CAT6A connectors shall exceed all component performance requirements for Augmented Category 6 in the ANSI/TIA-568 standard, as well as Class EA requirements as described in ISO/IEC 11801, from 1 MHz to 500 MHz to support the IEEE 802.3an standard for 10GBASE-T network performance.
   d. CAT6 Connectors shall exceed all component performance requirements for Category 6 in the ANSI/TIA-568-C.2 standard, as well as Class E requirements as described in ISO/IEC 11801, from 1 MHz to 250 MHz.
   e. Shielded connectors shall utilize the same form factor, design, and tool-less installation process as the unshielded connectors in the product line.

f. Shall be tested by an Independent testing body such as Intertek (ETL) for component compliance (i.e. "Component rated") to ANSI/TIA-568 and for POE+ applications. Test results shall be published and publicly available without special request.

2.3 MATERIALS

A. Copper Cable:

1. Inter-building outside-plant (OSP) cable shall be multi-pair unshielded twisted pair type, #24 AWG, Superior Essex type ANMA or equal. The wiring shall comply with the following:

   a. Maximum DC resistance: 26.5 Ohms Per 1000 feet

   b. Maximum mutual capacitance at 1 kHz: 15.7 nF per 1000 feet

   c. Nominal attenuation @ 1 MHz: 6.7 db per 1000 feet

   d. Characteristic impedance @ 1.0 Hz: 1.0 MHz: 100 Ohms (+) 15%

2. Interior backbone cable shall be multi-pair unshielded twisted pair type, #24 AWG, Superior Essex AR Series Riser Cable type ARMM or equal. The cable sheath shall be armored and riser-rated (CMR). The cable shall meet ANSI / TIA / EIA-568 standards for 100 ohm category 3 UTP multi-pair backbone cable and also comply with the following:

   a. Maximum DC resistance: 26.5 Ohms per 1000 feet

   b. Maximum mutual capacitance at 1 kHz: 15.7 nF per 1000 feet

   c. Nominal attenuation @ 1 MHz: 7.6 db per 1000 feet

   d. Characteristic impedance @ 1.0 – 16.0 MHz: 100 Ohms, (+) 15%

3. Inter-building and interior backbone cable shall meet the following requirements.

   a. Cable Conductors specifications:

      1) 24 AWG solid copper conductors.

      2) Individual conductors PVC jacketed.

   b. Cable construction specifications:

      1) Core wrap – Polypropylene film.

      2) Shield – Corrugated aluminum tape bonded to riser-rated jacket.

   c. Cable Jacket marking: Must be legible and shall contain the following

information:

1) Manufacturer's name.

2) Copper conductor gauge.

3) Pair counts.

4) UL and CSA listing.

5) Manufacturer's trademark.

6) Category rating.

7) Sequential foot markings, in 1-foot increments.

d. Cable jacket shall be gray with black lettering.

e. Backbone cabling shall have the following characteristics:

4. Horizontal distribution cable in conduit shall consist of four unshielded twisted pairs, #23 AWG, BerkTek Lanmark Cat. 6A type CMR or equal, with the following characteristics: Cable shall be characterized to 750 MHz and UL/ETL Listed by the Manufacturer printed on the cable jacket and package, as well as Intertek (ETL) Verified to TIA-568 Category 6A and ISO/IEC 11801 Class EA requirements for channel, link and component performance to support IEEE 10GBASE-T (802.3an) networks.

5. Horizontal distribution cable, where not installed in conduit in plenum spaces, shall be plenum rated and consist of four unshielded twisted pairs, #23 AWG, BerkTek Lanmark Cat. 6A type CMP or equal, with the following characteristics: Cable shall be characterized to 750 MHz and UL/ETL Listed by the Manufacturer printed on the cable jacket and package, as well as Intertek (ETL) Verified to TIA-568 Category 6A and ISO/IEC 11801 Class EA requirements for channel, link and component performance to support IEEE 10GBASE-T (802.3an) networks..

6. Horizontal cable shall meet the following requirements.

a. Cable jacket marking: Must be legible and shall contain the following information:

1) Manufacturer's name.

2) Copper conductor gauge.

3) Pair counts.

4) UL and CSA listing.

5) Manufacturer's trademark.

6) Category rating.

7) Sequential foot markings, in 2-foot increments.

b. Telecom station (and wireless antenna) cable jacket shall be blue with black lettering and shall be in 1000-foot boxes.

c. The jacket for telecom cabling serving AV devices and equipment shall be yellow with black lettering and shall be in 1000-foot boxes.

d. Type CMR cable shall be solid annealed copper with polyolefin insulation round design with flexible web separator with flame retardant PVC jacket.

e. Type CMP cable shall be same as Type CMR except with type FEP insulation.

7. Data Equipment Inter-Connect patch Cords: Four twisted-pair stranded, Category 6A, 24 AWG copper conductors. Individual conductors PVC jacketed. Each conductor provided with unique color code. Manufacturer terminated on each end with Ortronics or Systimax Category 6A 8-pin / 8-position modular plug to be pinned as per EIA / TIA 568 C. Connector plug shall be polarized to prevent polarity reversal or split pairs, and shall be factory-marked to indicate top of connector. Inter-connect cord shall be UL listed.

a. The Contractor shall complete data interconnects between patch panels and Owner-provided active network electronics.

b. Lengths as required running from the data station cable terminations to the ports on equipment mounted in any rack position. Minimum length shall be 5 feet and the maximum length shall be 15 feet.

B. Fiber Optic Cables

1. The mechanical and environmental specifications for fiber optic cable shall be in accordance with ANSI/TIA-492.AAAC-B, Bellcore, FDDI, and NEC sections 770-6(b) and (c) standards. Optical fiber cables run shall be low-water-peak singlemode (OS2), and meet all of the requirements delineated within the specifications of ANSI/TIA-568.

a. Cable shall meet/exceed Bellcore TR-TSY-000020, FDDI and NEC sections 770-6(b) and (c) standards.

b. Strand counts shall be per drawings.

2. Singlemode inter-building (exterior) backbone fiber optic cable shall be outside plant rated, with number of single mode strands as noted on the drawings, with dielectric central member, non-armored, water-blocking material, ripcord, dielectric strength member over loose buffer tubes, and polyethylene jacket, BerkTek, Superior Essex (11---9T01) Loose Tube Single Jacket All-Dielectric Cable or equal, and shall meet/exceed the following cable characteristics:

a. Single mode Core / Cladding size: 8.31/125um

b. Maximum attenuation: 0.40 dB/km @ 1310nm, 0.30 dB/km @ 1550nm

3. Singlemode indoor backbone fiber optic cable shall be plenum rated, with number of single mode strands as noted on the drawings, with dielectric central member, non-armored, ripcord, dielectric strength member over TB11 buffered fiber, PVC jacket, BerkTek, Superior Essex (44---9101) or equal, and shall meet/exceed the following cable characteristics:

   a. Single mode Core/Cladding size: 8.3/125um

   b. Maximum attenuation: 0.40 dB/km @ 1310nm, 0.30 dB/km @ 1550nm

3. All cable assemblies are to be Leviton Opt-X type or equal.

4. General Fiber Optic Cable Requirements:

   a. See the Drawings for required fiber counts and routing.

   b. ANSI.EIA/TIA-568B-B.3 Addendum 1.

   c. The cable manufacturer must guarantee the supplied single mode fiber optic cable will meet the specifications covering latest following standards and network applications using standard off-the-shelf, non-proprietary network hardware:

      1) OC-12 625 Mb/s

      2) OC-48 1024 Mb/s

      3) IEEE 1000 Base SX 1000 Mb/s

      4) ATM 625 Mb/s

      5) ATM 1.2 Gbps

      6) Fiber Channel 1.062 Gbps

   e. Fiber optic cable sheath construction shall be of a tight-buffered MIC style design with integrated strength member.

   f. The fiber optic cable shall have an integrated strength member, which is a high tensile strength dielectric providing axial strength and anti-buckling properties for the fibers.

   g. The fiber optic cable shall utilize aramid yarn as a flexible strength member surrounding the buffered fibers beneath the cable jacket.

   h. The individual fibers in a tight-buffered fiber optic cable shall be placed in groups of 6 or 12 fiber strands per subunit.

   i. The individual subunits shall be color coded for easy identifications.

   j. The cable tensile load rating shall be a maximum of 461 lbf for a 24-fiber count 6-fiber subunit.

k. The cable minimum bend radius at 0-150lbs pulling or handling load shall be 10 times the outside diameter of the sheath.

l. The cable minimum bend radius at 151-600 kbs pulling or handling load shall be 20 times the outside diameter of the sheath.

m. The fiber optic cable shall be low smoke, flame retardant and shall meet the flame test requirements of UL 910. It shall be UL listed as OFNP.

n. Fiber optic connectors shall be duplex SC.

o. Fiber optic patch cables LC to SC shall be duplex with an oval over-sheath. Each fiber shall be labeled 'A' or 'B' to provide fast identification of "Transmit" and "Receive" fibers in patching between network electronics and backbone connections. Fiber optic duplex patch cables shall be provided in a 15 foot length as follows:

1) Avaya FL3EP-EP-15 or Leviton 5LDLC-M05.

C. Data Outlets

1. Cable termination hardware shall be individual; Category 6A rated Leviton (or equal) jacks. The listed product shall have the following characteristics:

a. One eight-position, eight-conductor jack (non-keyed), TIA/EIA-568-C Compliant, wired to T568B, Leviton category 6A.

b. The cover of the information outlet shall be labeled above the jack. The number on the outlet jacks shall coincide with the identification requirements listed in Part 3 of this Section below.

c. The color of all general use jacks shall be blue.

d. The color of all jacks at AV-related devices or racks shall be yellow.

e. The color of all faceplates and blank inserts or visible mounting plates shall match the adjacent power or signal outlet covers on the project (provided under another Section).

f. The devices at outlets and the devices in the patch panels shall be of the same manufacturer and same type.

g. See Drawings for number of jacks at each outlet, jack arrangement, and mounting type.

2. The 8-pin 8-position jacks at terminal blocks and at each 4-pair termination shall be labeled with laser-printed polyester self-laminating wrap-around labels.

a. Eight-pin 8-position jack label-faceplates;

1) All labels shall be polyester and white in color;

2) All labels shall be 1.80-inch in width and 0.375-inch in length;

3) Labels shall have an adhesive backing;

4) Labels shall be attached to the faceplate by adhesive and clipping in behind the snap in clear plastic cover;

5) Labels shall be laser printed with the labeling scheme as specified;

6) Labels shall be Panduit Pan-CODE Laser Labels (PLL) part EFPL-1, Leviton LabelWare, or equal.

b. Terminal block designation strip:

1) All labels shall be polyester;

2) Labels shall be white in color for 4-pair data station cable terminations, located within a blue plastic label holder;

3) Labels shall be attached to the designation strip provided with the blue plastic holders;

4) All labels shall be 7.88 inches in width and 0.50 inches in length;

5) Labels shall have an adhesive backing;

6) Labels shall be laser-printed with the labeling scheme as specified;

7) Labels shall be Panduit Pan-CODE Laser Labels (PLL) part number PLL-22-Y3-1, Leviton LabelWare, or equal.

3. Labeling for all cable, jacks, and other elements of the telecom cabling system shall follow TIA/EIA-606 Standards. Provide color-coded labels for all wiring blocks as follows:

a. Interface to Site Cabling – Brown

b. Interface to Equipment Cabling – Purple

c. Interface to Horizontal Cabling – Blue

d. Interface to Telephone Company - Green

D. Termination Hardware at MDF /IDF/BDF's (Fiber Optic)

1. Optical Fiber Interconnect Equipment: Interconnect equipment shall be mounted on four post equipment racks. Interconnect equipment shall affixed to the rack by at least (4a) screws. The screws shall be the correct size and thread configuration for the holes in the rack. The screws shall be tightened to the extent that they hold the equipment firmly to the rack, without distorting the equipment or stripping the threads. All optical fiber interconnect devices shall be assembled and installed in

accordance with the manufacturer's instructions and recommendations.

2. Fiber Interconnect Equipment shall be of sufficient size to permit termination of all fiber strands, maintaining minimum bend radius for singlemode cables, and maintaining required cable storage. In the event that an enclosure must be oversized (number of termination ports) due to manufacturer's product standardization, the next larger available enclosure size shall be utilized.

3. Adapter plates, which accommodate Duplex LC type connectors, shall be provided within each Fiber Optic Distribution Panel (unless otherwise noted on the drawings). Singlemode connectors (quantity and type as indicated on the drawings) shall be included on adapter plates.

    a. The duplex adapter at the main distribution frame (MDF) shall be mounted in a B-A configuration.

    b. The duplex adapter at each intermediate distribution frame (IDF) shall be mounted in an A-B configuration for cables coming from the MDF, and in a B-A configuration for cables going to an additional IDF/BDF (if applicable) further downstream.

4. Fiber optic distribution panels shall be rack-mount type, utilizing Leviton Opt-X fiber System components, or equal, with fiber capacity as indicated on the drawings, equipped with snap-in adapter panels.

    a. Provide quantity of connector panels for complete termination of all fiber strands, complete with duplex LC adapters.

    b. Provide blank connector plates for all spaces not equipped with adapter panels.

5. All glass strands of each fiber optic cable shall be terminated on Leviton Fast Cure type duplex connectors which require no epoxy or heat cure devices, allow re-termination to reduce waste, and have the following characteristics:

    a. Singlemode: ceramic ferrule

    b. 568SC style

    c. Plastic housing

    d. Low loss – 0.2 db (typical), 0.5 (guaranteed)

6. All inter-building fiber optic cables (loose tube type) shall be terminated at fiber optic distribution panels using a Leviton 49887 Series (or equal) buffer tube fan-out kit.

7. Labeling for fiber optic cabling and distribution panels shall match the labeling system for data cabling and hardware.

E. Termination Hardware at MDF / IDF/BDF's (Data)

1. All cables installed application shall be terminated in rack-mounted modular patch panels and the entire installation shall be in compliance with TIA/EIA-568-B Category 6A requirements.

2. Patch panels shall be Leviton Category 6A discrete port-type. Port panels shall be certified by the manufacturer as suitable for 1000 Mbps data transmission. Patch panels shall be manufactured of aluminum or steel.

3. Wire management hardware shall be Leviton Versi-Duct 49265 Series, or equal, installed at both the top and the bottom and between each patch panel and along the sides of the rack for patch cable routing and management.

4. Wire managers shall be of sufficient width and depth to permit orderly routing of all patch cables at one hundred percent utilization.

5. Patch panels shall be mounted on equipment racks. Panels shall be affixed to the rack by at least four (4) screws. The screws shall be of the correct size and thread configuration for the holes in the rack. They shall be tightened to the extent that they hold the equipment firmly to the rack, without distorting the equipment or stripping the threads.

6. Patch panel quantity of ports as noted on the drawings.

F. Equipment Racks

1. Floor mounted, four post, open bay relay type racks shall be utilized in equipment rooms to provide adequate mounting space for patch panels, wire managers, fiber optic distribution panels, and network integration equipment.

2. Equipment racks shall be supported or braced at the top of each rack by a length of unistrut. Unistrut shall be attached to full height wall by the appropriate fastening hardware. Equipment racks shall have the following physical characteristics, unless otherwise noted:

3. Equipment Racks shall be 7-feet X 19 inch 6061-T6 aluminum, bolt-down EIA standard equipment rack, with 1-1/4 X ½-inch front and rear flange hole pattern, 12-24 threaded holes, clear finish, and self-support base, UL listed. Each rack line up shall be equipped with a rack storage drawer.

   a. Four post Equipment rack, Chatsworth 15251-103

   b. Equipment cable guard, clear, Chatsworth 40058-519.

   c. Seismic gussets for each rack, black, Chatsworth 11592-701.

   d. Rack storage drawer, clear, Chatsworth 41050-519.

   e. Rack storage drawer, clear, Chatsworth 11505-519.

   f. Vertical plug strip, ivory, Wiremold, Plugmold 2400, V24GB606.

4. Horizontal cable trough for equipment racks.

    a. Patch cable organizers with 6.00 X 2.80-inch horizontal rings for routing patch cables across equipment racks to equipment ports. Panel shall fit in 2 rack units and match the color of the equipment racks, Chatsworth Products, clear. Chatsworth Products Large Horizontal Ring Panel 11564-519 or Leviton #49253-BCM.

5. Vertical rack cabling sections:

    a. For use on the vertical edge rail of the equipment racks as indicated on Drawings.

    b. Seven-foot X 12.75-inch rectangular channel with latching cable retainers shall be Chatsworth Products Inc., Two-Sided Vertical Rack Cabling Section 11729-503, and color shall be the same as the equipment racks, clear finish.

    c. Provide (1) PDU per rack or wall cabinet. Unswitched, non-surge suppressed. 48" Vertical for floor-mounted racks and cabinets.

6. Fiber patch cord management:

    a. For use in the vertical rack cabling section for the routing of fiber optic patch cables.

    b. Two-inch square, covered, yellow in color, slotted duct shall be 6 feet long, with cover. Duct shall be ADC FGS-MSHS-C.

7. Fiber optic termination panel labels.

    a. Fiber optic termination panels shall be labeled using the plastic panel provided by the termination panel manufacturer. The plastic panel shall be overlaid with a one-piece adhesive backed-sheet. Contractor shall cut the sheet to size.

    b. Eight-and-a-half-inch x 11-inch laser printable adhesive backed sheets: Avery 5165.

G. Steel wire cable tray.

1. Wire cable tray for communications cables: Wire tray shall be constructed of welded wire mesh with a continuous safety-edge wire lip. Provide a mesh cable tray system for continuous support of communications cables. The wire cable tray shall be manufactured system complete with all required mounting hardware and withal fittings and cables needed to form a bonded (grounded) system; straight and curved sections in specified widths.

2. The wire cable tray shall be manufactured from carbon steel high strength wire. The wire shall be welded, bent and surface treated after the wire manufacturing process.

3. The wire tray finish shall be hot dip galvanized.

4. The maximum wire mesh size shall be 4 inches by 2 inches.

5. The wire tray depth shall be 2 inches.

6. The wire tray width shall be 12 inches or as otherwise indicated on the Drawings.

7. Each Section of the wire tray shall be bonded to a continuous insulated #6 AWG copper ground wire.

H. Cable runway:

1. Cable runway: UL listed, tubular steel side rails, 1 ½ - inch x 0.375-inch, with 1-1/2-inch stringers on 9-inch centers, 1-1/2-inch x 1-inch welded rungs, and tubular removable posts; yellow zinc dichromate (UZN) finish, complete with all required mounting hardware, fittings and cables needed to form a bonded (grounded) system.

a. Cable runway: Chatsworth 10250 Universal Cable Runway, or equal, 12 inch wide, or as otherwise indicated on the Drawings.

PART 3 – EXECUTION

3.1 CABLE AND WIRE INSTALLATION:

A. This contractor shall be responsible for the provision and installation of all telecom cables including all supports, hangers, and hardware necessary for a complete installation. Under no circumstances shall cables be laid on the suspended ceiling. This contractor shall be responsible for providing and installing all necessary cable support hardware to meet Category 6A requirements. Refer also to Section 262700 Basic Materials & Methods:

1. T-Bar Suspended Ceilings: Copper station cabling may be run outside of conduits when routed above T-Bar suspended ceilings. Cables installed in this fashion are to be run horizontally in bundles and tied down neatly suspended from J-hooks, and well clear of any light fixtures or other electrical appliances that may affect data transmissions.

B. At each telecom room cables are to be segregated by type, neatly tied together, properly dressed, and routed to the patch panels. All cables shall be tagged.

C. Cable distances from patch panels to data outlet shall not exceed 295 feet. This contractor is responsible to ensure the distance specified is not exceeded.

D. Care shall be exercised in routing both station and backbone/tie cables so as to avoid areas where sources of high levels of EMI (such as electric motors, transformers and fluorescent lighting fixtures) may exist. Maintain a minimum distance of 12" for

voltages of 3KVA or less and 36" separation for voltage of 5KVA and more from these sources when run parallel. Cross at 90-degree angles where crossing must occur.

E. Each station cable shall be "home run" (no splices or cross connection points) between jacks and patch panels.

F. All openings or raceway transitions through firewalls and floors shall utilize UL listed fire-rated penetrations.

G. The fiber optical cable manufacturer's installation instructions shall be followed in order to avoid damage during placement within the facility. All fiber optic cable shall be placed within innerduct to provide mechanical protection and to provide visual warning or caution when handling or other work operations are performed adjacent to the installed fiber cable.

H. No more than (2) 90-degree bends shall be allowed on all conduit runs for the horizontal voice/data cabling system, without an intermediate pullbox or junction box.

I. Station cable terminations.

1. Cable pair twists of Category 6A Cable shall be maintained within 0.5-inch of the point of termination. Under no circumstances shall cable pairs be untwisted or otherwise altered prior to termination.

2. Do not bend Category 6A station cables to a radius of less than 4 times the cable diameter - approximately 2-inches.

3. Allow slack in Category 6A cable bundles at entrances and exits of conduit sleeves and at transitions from "J" hooks to cable trays. Do not exceed maximum 25 pounds of pulling tension on cabling. Never pull cables tight at cable tray transitions; doing so may damage the cables by crimping them on the cable tray side of the bundles.

4. Keep the cable evenly distributed within the cable tray. Do not allow the cables or bundles to be pulled tight against the splines or to be unevenly balanced on one side of the tray.

5. Bundles of station cable in floor slots shall not exceed 2.5 inches in diameter, and shall be spaced 4 inches apart for proper fire stopping of the floor slot.

6. Bundles of station cable in 4-inch floor sleeves shall not exceed a 39 percent fill.

J. Fiber optic cable and termination installation.

1. The Contractor shall place all optical fiber backbone cabling in accordance with these Specifications, and as indicated on the Drawings.

2. Fiber optic cables: After dressing the cable to its final destination, sheath shall be

removed to a point that allows the strands to be placed in break out kits to be splayed and terminated in a neat and uniform fashion. At this point all fibers shall be terminated in strict compliance with the manufacturer's submitted instructions.

a. Cable sheaths shall be clamped to the outside of fiber termination shelf. The cable clamp shall be manufactured by the manufacturer of the termination shelf and shall be designed to clamp outside plant fiber optic cable sheaths.

b. The tight-buffered sheath cable shall have the OFNR sheath and Kevlar strength members terminated at the cable clamp on the outside of the shelf. Only the buffer tubes and buffered fibers shall continue into the termination shelf.

c. Provide a minimum of 48-inches of subunit buffer tube and 40 inches of buffered fiber inside of the termination shelf.

K. Where fiber or copper cable enters an equipment room, it shall be affixed to the backboard via "D" Rings and cable ties. All cable shall be neatly bundled, combed, and tied. All exposed cable runs shall be horizontal or vertical, and bends shall comply with manufacturer required minimum cable bending radii.

M. All openings into wall mounted cabinets and fiber optic distribution panels shall have grommets for the protection of cabling.

N. Fiber innerduct shall be installed in accordance with manufacturers instructions and industry standards. Within the equipment rooms, the innerduct shall extend from the end of conduit to (4) feet above the floor and shall be affixed to the backboard by means of clamps designed for that purpose. Care shall be taken to avoid kinking the innerduct or applying excessive tension during the installation process.

1. Innerduct runs do not have to be continuous throughout. Breaks are acceptable at pull boxes where required. This contractor is responsible for determination of actual lengths of innerduct required. This contractor is responsible for determination of actual lengths of innerduct required. Enough innerduct shall be provided and installed to extend from the fiber service loops at the MDF to the fiber service loops at each IDF. In pullboxes, segments of innerduct shall extend a minimum of (12) inches into the pullbox.

O. During installation of optical fiber cable in conduit, special care shall be taken to avoid damage to the cable. While under pulling tension, the cable shall not be bent into a curve with a radius of less than (20) times the cable diameter. Pulling tension shall not exceed manufacturer's recommended maximum tensile load. Contractor shall utilize a winch with tension control or a "break-away" link designed to break away at or below the recommended maximum tension.

P. A minimum (30) foot service loop shall be provided at each terminal location for all fiber optic cables. Provide service loop via backboard attached cable reels.

Q. Each end of gel-filled voice cable shall be dammed at the breakout point-using manufacturer recommended blocking kit. All pairs extending beyond the breakout point and dam shall be cleaned such that no gel remains.

R. Provide (1) patch cable for each activated jack on the project. Lengths shall be 5ft. minimum or as required for the MDF or IDF design. Patch cords shall be factory tested to ensure compliance with current standards.

S. Provide one fiber jumper for each two strands of fiber at each equipment rack, with duplex SC type connectors unless otherwise noted on the drawings.

T. Equipment racks and Frames.

1. Equipment racks shall be assembled and mounted in locations noted on the drawings and as described herein. Each rack shall be assembled in accordance with the manufacturer's instructions and recommendations. Each rack shall be mounted such that the side rails are plumb. Each rack shall be affixed to the building structure at each of the mounting holes provided. Attachment shall be by 1/2" X 1-1/4" lag bolts. A 3/8" pilot hole shall be drilled for each lag bolt. Each bolt shall be tightened to the extent that it holds the mounting hardware firmly, but not so tight as to distort the hardware or strip the threads

2. Provide seismic support and bracing for all equipment racks installed under this work. Equipment racks must be structurally designed to accommodate cable loads. No other support mechanism will be supplied. Comply with Division 1 of these Specifications. Provide seismic design calculations and seismic design drawings prepared by the contractor's structural engineer for coordination and approval by Owner's Representative prior to fabricating or installing any supports. In general, provide support only from floor slabs, beams, columns, or structural walls, (such as shear walls). Do NOT use existing or new partitions to provide either vertical or lateral support UNLESS the seismic design calculations and drawings demonstrate that the partition, either with or without reinforcement, is able to support the seismic and other loads. Any proposed reinforcement to be the responsibility of the Contractor.

3. Relay racks:

a. Assemble equipment racks with cable management hardware specified.

b. Fasten the equipment racks to the steel wire cable tray or cable ladder with equipment rack brackets.

c. Place a base dust cover panel over the area between the front and rear base flange of each equipment rack.

d. Place horizontal ring style cable managers in the racks at the positions shown on the drawings. Relocate the cable managers within the racks as required to accommodate the installation of network electronics and to manage the copper and fiber patch cables installed for use with this system.

e. Horizontal cable troughs for managing patch cables routing to equipment ports shall be placed on equipment racks.

1) Six horizontal ring panels shall be placed in 7-foot equipment racks.

2) Six Philips head screws, threaded to the 12-24 threading of the equipment racks shall be used to attach each horizontal trough.

f. A vertical rack cabling section shall be placed on each of the 2 vertical edge rails of the equipment racks. Attach the 2-sided vertical rack cabling section to the equipment racks at the location of the threaded inserts. The 2-sided vertical rack cabling section shall be bolted to the threaded inserts in the side rails of the each equipment rack with four 1/2 –inch hex head bolts and lock washers.

U. Labeling: Labeling shall include, but not be limited to:

1. Labeling telecommunications outlet faceplates;

2. Labeling station cables;

3. Labeling terminal blocks;

4. Labeling fiber optic cable sheaths;

5. Labeling fiber optic and copper splice closures;

6. Labeling fiber optic stands;

7. Labeling fiber termination panels;

8. Labeling of telecommunications equipment racks and fiber frames;

9. Labeling of telecommunications pathways, including conduits, steel wire cable trays, cable runway and pullboxes;

10. Labeling of all grounding conductors and ground bars in the Intermediate Distribution Facilities (IDFs) and Main Distribution Frame (MDF).

11. The intent of the final labeling is to allow the Owner or persons contracted by the Owner to identify any part of the structured cabling system through physical identification of the components and their related components at the specified access point without the use of electrical, electronic or mechanical means of identification.

12. Equipment rack and cable tray / pullbox labels:

a. Equipment Racks shall be clearly labeled as follows:

1) Labels shall be adhesive backed individual letters and numbers.

2) Individual letters shall be 3/4*-inch in width and 1-inch in height.

3) Individual characters shall be self-spacing by simply butting the individual characters against each other in a row.

4) Characters shall be either white or yellow on a black background.

5) Labels shall be designed for exposed outdoor applications.

6) Labels shall be:

(a) 3M Scotchcal 5003 Non-Reflective Lettering Systems.

(b) Panduit, PVL100YB.

(c) Or equal.

b. Cable Tray Labeling:

1) Cable tray shall be provided with a label clip fastened to the underside.

2) Label clip shall be 3.94-inches wide by 0.63-inch high and shall attach to the cable tray without the use of additional fasteners;

3) Label clips shall be attached to each label clip:

(a) All labels shall be polyester with white color;

(b) All labels shall be at least 3.00 inches in width and 0.38-inch in length;

(c) Labels shall have an adhesive backing;

(d) Labels shall be attached to label clips with the adhesive back self-laminating portion;

(e) Labels shall be laser printed with the labeling scheme as specified;

(f) Label shall be 0.25-inch high, Ariel San Serif;

(g) Labels shall be Panduit, Pan-CODE Laser Labels (PLL) part number PLL-19-Y2, or equal.

c. Labeling at Pull Box:

1) Cover and interior labeling for pull box:

(a) All labels shall be polyester with white color;

(b) All labels shall be at least 1.88- inches in width and 0.83-inch in length;

(c) Labels shall have an adhesive backing;

(d) Labels shall be attached on cover and interior of pullbox at locations indicated on the Drawings with the adhesive back self-laminating portion.

(e) Labels shall be laser printed with a labeling scheme approved by the Owner's Representative.

(f) Label shall be 0.25-inch high, Ariel San Serif;

(g) Labels shall be Panduit, Pan-CODE Laser Labels (PLL) part number PLL-19-Y2, or equal.

2) Cover and interior labeling for conduit at pull box:

(a) All labels shall be polyester with white color.

(b) All labels shall be at least 1.88- inches in width and 0.83-inch in length;

(c) Labels shall have an adhesive backing;

(d) Labels shall be attached on cover and interior of pullbox with the adhesive back self-laminating portion at location where conduit enters the pullbox.

(e) Labels shall be laser printed with a labeling scheme approved by the Owner's Representative.

13. Copper station – cable sheath labels:

a. Copper station cable sheaths at 8-pin 8-position jacks, at junction boxes, enclosures, and pull boxes shall be labeled with laser-printed polyester self-laminating wrap-around labels.

1) All labels shall be polyester with white color.

2) All labels shall be at least 1.00- inches in width and 1.33-inch in length; with a 0.5-inch x 1-inch printable area;

3) Labels shall have an adhesive backing;

4) Labels shall be attaché to cable sheaths by wrapping around the sheath with the adhesive back self-laminating portion;

5) Labels shall be laser printed with the labeling scheme as specified;

14. Cable / outlet / jack / termination identification:

a. Each copper cable, its associated jack at the outlet, and the associated C-4 connecting block on the terminal block or patch panel shall be labeled with a

unique identifier consisting of the following:

1) The IDF room number where the station cable is terminated, ###.

2) The end user room number in which the 4-pair cable is terminated and the telecommunications outlet is located, ###.

3) A 3-digit serial number, rest to 001 for each room, which sequentially identifies each telecommunications jack / cable in a room, ###.

4) The type of service provided by a Particular cable, either D for data or V for voice.

5) Example of IDF 107, user room 129, jack /cable number 1 (data cable): 107-129-001-D.

b. The following are examples of the numbering scheme:

1) IDF room 1.1, User Rm. 111, Jack/ cable 1, Data line.

1.1-111-001-D

(a) IDF Number: 1.1

(b) Room Number: 111

(c) Serial Number: 001

(d) Data Line: D

2) IDF room 1.1, User Rm. 106, Jack / cable, Voice line.

1.1-106-001-V

(a) IDF Number: 1.1

(b) Room Number: 106

(c) Serial Number: 001

(d) Voice Line: V

15. Cable identification:

a. Each fiber optic backbone cable sheath shall be labeled with a unique identifier as shown on the Drawings.

b. Label the cable sheath at the termination shelf and on the innerduct as the fiber optic cables pass through IDFs and pull boxes.

c. Each SC connector in each termination shelve shall be labeled with a unique identifier as noted on the Drawings.

16. Cable sheath identification:

    a. Identify multi-pair copper riser cable sheaths with machine-generated labels at the following locations:

        1) Within 12 inches of the point that the cable exits the top or bottom of the 110P-type terminal block column.

        2) Within 12 inches of the point that the cable enters a splice.

        3) At 40-foot intervals above T-Bar ceilings.

        4) At pull boxes

        5) Within 12 inches of the point that the cable enters or exits wall and floor sleeves.

17. Warning Tags: At each location where fiber cable is exposed, it shall be marked with warning tags. These tags shall be yellow or orange in color, and shall contain the warning: "CAUTION FIBER OPTIC CABLE". The text shall be permanent, black, block characters, and at least 3/16 high. A warning tag shall be permanently affixed to each exposed cable or bundle of cables, at intervals of not more than (5) feet. Any section of exposed cable, which is less than five (5) feet in length, shall have at least one warning tag affixed to it.

3.2 GROUNDING SYSTEM AND CONDUCTORS

A. Bonding and Grounding:

1. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Guidelines of ANSI/TIA-607-B shall be followed. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment.

B. Telecommunications Bonding Backbone:

1. Provide a Telecommunications Bonding Backbone utilizing a minimum #6 AWG bonding conductor (or as shown on drawings) that provides direct bonding between equipment rooms and telecommunications closets. Connect this bonding backbone cable to the main grounding electrode system at the electric service switchboard.

2. Provide a copper ground bar at each tel/data equipment room or rack location, connected to the bonding backbone.

3. Provide a #6 AWG stranded copper cable from each ground bar to each adjacent rack or cable trays system.

3.3 PROTECTION BLOCKS

A. Protection:

1. Provide protection blocks at each building entry for copper site cable terminations.

2. Provide sufficient capacity for protections of all pairs.

3. Materials: As indicated on the Drawings.

3.4 FIRE AND SMOKE PARTITION PENETRATIONS

A. Conduit sleeves shall be provided as part of this contract as a means of routing cables through fire-rated walls and floors. Openings in sleeves and conduits used for system cables and those that remain (empty) spare shall be sealed with an approved fireproof, removable sagging material at completion. Sleeves, which pass vertically from floor to floor, shall be sealed in a similar manner using an approved re-enterable system. Additional penetrations through rated assemblies, necessary for passage of voice/data wiring, shall be made using an approved method and permanently sealed after installation of cables. UL systems must be available for each firestop penetration and included in the submittal. All firestop products must be readily available at local electrical and/or datacom distribution outlets.

3.5 STEEL WIRE CABLE TRAY

A. Provide seismic support and bracing for all steel wire cable tray installed under this work. Steel wire cable tray shall be designed to accommodate the large cable loads expected in the MDF and IDFs. No other support mechanism will be supplied. Comply with Division 1 of these specifications. Provide seismic design calculations and seismic design drawings prepared by the Contractor's structural Engineer for coordination and approval by the Architect prior to fabricating or installing any supports. Any proposed reinforcement to be the responsibility of the Contractor. Coordinate seismic design with architectural, structural, mechanical, electrical, plumbing, fire protection and other trades.

B. Wire tray shall be installed in the MDF and IDFs at 7 feet 0 inches AFF or as otherwise indicated on the Drawings.

C. Wire tray shall be leveled to a tolerance of 1/8-inch over 10 feet of cable runway.

D. Wire tray fittings: shall be used to join and support the wire tray segments.

E. Wire tray shall be supported at a maximum of 4-foot centers from the structure above using trapeze assemblies.

F. Cut openings in the cable tray grid 6 inches wide and 6 inches deep above the vertical

cable managers at the equipment racks to allow the data interconnect cables to be easily routed.

G. Wire tray sections shall be bonded together with the manufacturer's fittings.

H. All field cut wire tray shall be deburred and all sharp edges shall be ground smooth prior to placement.

I. Coordinate the placement of fiber guide down spouts with the placemen of steel wire cable tray grid to insure an unobstructed path for fiber optic patch cables.

J. Mounting plates and 'J' bolts and splice washers shall be used to attach the steel wire cable tray grid to insure an unobstructed path for fiber optic patch cables.

3. Align the downspouts with the inter-bay management panels on the front-facing fiber distribution frame.

4. The fiber guide shall be leveled to within 1/8-inch over 8 feet.

5. Tighten all fastening and joining hardware to the manufacturer's specifications. Replace any damaged bolts, washers and nuts.

3.6 PLYWOOD BACKBOARDS

A. Provide backboards shall be fire retardant, ¾-inch A-B grade plywood, void free, 2440-mm (8 feet) high unless otherwise noted, capable of supporting attached equipment, and painted with a minimum of 2 coats of fire retardant off-white semi gloss paint. Manufacturer's stamps visible from the front side of the plywood backboard shall be masked to painting.

B. Plywood backboards shall be fastened to the structural members of the building only using an approved fastener. Plywood backboards shall not be anchored to GBW.

C. Plywood shall be mounted form +6-inches AFF to +8 feet 6-inches at the locations indicated on the Drawings.

D. Plywood backboards shall be cut to fit in width and shall have holes cut into the backboard to accommodate and provide access to devices behind the backboard, such as switches and outlets.

3.7 TESTING AND DOCUMENTATION

A. Fiber Optic Cable Test Equipment:

1. Cable tester shall be NRTL certified for compliance to be used as an Optical Loss Test Set.

2. Cable testers shall be Optical Power Meter and High Resolution Optical Time Domain Reflectometer (OTDR). The cable tester shall be NRTL certified for compliance to latest TIA/EIA performance requirements at 850, 1300, 1310 and 1550 nm.

3. Testers shall have been calibrated at least one year prior to use on this project. Calibration must be in accordance to IEC 61315 and IEC 61746 respectively. Contractor to provide proof to Owner if requested.

4. All testing equipment (OTDR, Light Loss, Splicer etc.) shall be owned by the Contractor. Contractor must prove ownership of equipment if requested

B. Cable segments and links shall be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

C. The system will not be considered certified until the tester has certified to the Owner that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.

D. Testing Procedures:

1. Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.

2. Prior to testing, all connectors shall be properly cleaned with an approved product manufactured specifically for this purpose.

3. Prior to beginning testing, confirm that all testing equipment is fully charged or operating on building power. If the test equipment power levels drop below 50%, recharge unit or continue testing with a different (fully charged) tester.

4. Initially test optical cable with a light source and power meter utilizing procedures as stated in TIA TSB-140, ANSI/TIA/EIA-526-7, ANSI/TIA/EIA-526-14A, TIA-516-14B, OFSTP-14A Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant and ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss in installed Single-Mode Fiber cable plant.

5. Measured results shall be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with Optical Time Domain Reflectometer (OTDR) to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the Owner.

E. Single-Mode Fiber Optic Cables:

1. Shall be tested bi-directionally for length and attenuation at both the short and long wavelengths for Single-Mode fiber (1310 and 1550 nm) as specified in TIA TSB-140.

2. Single-mode fibers shall be dual wave length and provide attenuated wavelength of the 1310 nm and 1550 nm. 850 nm for single-mode fiber shall not be acceptable under any circumstances.

F. All cables shall be tested after termination using a cable certification tester that contains the test equipment manufacturer's most current version of firmware.

G. Test all fiber optic cable segments end-to-end from the fiber optic backbone patch panel in the Equipment Room to each fiber optic backbone patch panel in each Telecommunications Room.

H. Broken or faulty strands will not be accepted. Any cable not fully functional with all strands usable shall be replaced at no cost to the Owner.

I. Upon completion of testing, all connectors shall be capped with a product made for that specific function by the connecting hardware manufacturer to prevent the contamination of the fiber from construction debris or other foreign objects.

J. Test Results:

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.

2. Test results saved by the tester shall be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

3. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.

4. Test results saved by the tester shall be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

5. Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).

6. Test results shall include the following:

a. Telecommunications Room number

b. Location of fiber pull i.e. (Equipment Room # to Telecom Room #)

c. Patch panel # and location

d. Connector type

e. Distance

f. Wavelength tested

g. Technician who performed the testing

K. The Owner and Architect reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

3.8 COPPER CABLE TESTING AND DOCUMENTATION

A. Cabling systems shall meet or exceed the electrical and transmission characteristics of the systems specified.

B. Cable segments and links shall be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).

C. The system shall not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.

D. After the installation is complete, in addition to any other required testing as described herein, and at such times as the Owner or Architect directs, the Contractor shall be present while the Owner conducts an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests performed again.

E. After review of the completed test results, the Owner reserves the right to retest the installed cables, utilizing the Contractor's tester and the Contractor's labor.

F. Equipment Manufacturer's Factory Test

1. Each cable and equipment manufacturer shall factory test their respective products being installed on this project and provide test reports at time of delivery. Provide separate respective test reports indicating that they meet or exceed the latest applicable TIA/EIA Standards and technical bulletins.

2. All other products relative to this specification shall be tested to its respective industry strictest standards.

3. Each manufacturer shall factory test their respective cable or equipment provided to this project at several lower frequency levels, including the minimum and maximum frequency level indicated herein. The test reports shall indicate test results for at least five equal incremental frequency levels including the maximum required.

G. Field Testing Equipment: Submit during shop drawing review on the testing equipment to be utilized on this project. The installer shall test all cables installed under this Section.

1. Unshielded Twisted Pair Testing Equipment:

a. The cable tester shall have a wide variety of preprogrammed cable types as an integral part of its testing system and have the ability to test cables less than 6 feet (6ft.) from the test point.

b. Testing shall be accomplished using level III or higher field tester that is loaded with the most current version of test software by the manufacturer of the test equipment.

c. Provide factory calibration report of field test equipment.

H. Testing Procedures:

1. Testing shall conform to TIA-568-C.0 standard.

2. Testing shall be to the Permanent Link Test Parameters.

3. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

4. Test each UTP cable and passive components. Provide certification that entire installation of UTP cabling, equipment and jacks are NRTL certified meeting or exceeding a minimum of category performance specified on all four pairs of conductors.

5. Tests shall be based on each pair of conductors and not the aggregate multiple pair results.

6. Test all installed cable segments end-to-end, from the telecommunications room horizontal patch panel/cross connect block panel to each work area outlet and from each telecommunications room backbone patch panel/cross-connect block panel to respective main cross connect, and from the work area outlet to the main cross-connect (through patch cables or cross- connect wiring) with a Signal Injector, Graphical Link Testing Meter and Time Domain Reflectometer (TDR) for compliance to latest TIA performance requirements, as well as NEXT, ELFEXT, structural return loss, alternating power sum, opens, shorts, continuity, cable length, and characteristic impedance.

7. Provide report indicating failures and what actions were taken to ensure a passing horizontal cable and its terminations. Any cable failing the certification test (Fail, Fail* or, Pass*) must have remedial work done to provide a full pass test result; Remediation may include re-termination or replacement of the cable, which fails. Cables passing within tolerance only (Conditional Pass*) will not be accepted.

I. Test results:

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.

2. Test results saved by the tester shall be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.

3. Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).

4. Test Results shall include the following:

a. Applicable room number of jack location (room number per Contract Documents)

b. Applicable Telecommunications Room number

c. Circuit I.D. number with corresponding jack identifier

d. Wire Map – shall include the following:

(1) Continuity to the remote end

(2) Shorts between any two or more conductors

(3) Crossed pairs

(4) Reversed pairs

(5) Split pairs

(6) Any other mis-wiring

e. Length

f. Insertion Loss

g. Near-end Crosstalk (NEXT) Loss

h. PS-NEXT (Power Sum Near End Cross Talk)

i. ELFEXT (Equal Level Far End Cross Talk)

j. PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)

k. Propagation Delay

l. Delay Skew

m. Return loss

3.9 TRAINING AND PATCHING

A. The Contractor shall provide a minimum of (1) person for a minimum of (48) man-hours beginning with the first scheduled move-in date to train Owner personnel in maintenance and repair of cabling system. This technician shall also assist the Owner in patching telecom services throughout the facility during the move-in period. It is at this time that all Owner-provided connectivity for voice and data services will be provided to the Contractor. Patching of the station assignments between the Owner's services demark shall also be considered part of this Contractor's work.

3.10 ACCEPTANCE

A. Prior to acceptance all the following conditions must be met:

1. As required the Contractor shall make submittals and deficiencies or rejected submittals shall be corrected.

2. All specified cable management devices including cable ladder, steel wire cable tray, 2-sided vertical rack cabling sections, horizontal ring panels, and fiber optic troughs shall be installed as indicated and specified. All parts not installed shall be inventoried and provided to the Owner in the manufacturer's packaging.

3. All seismic bracing shall be in place.

4. All specified station cabling with associated termination components, labeling and fire stopping shall be installed properly. Any component not installed shall be inventoried and provided to the Owner in the manufacturer's packaging; loose miscellaneous parts shall not be accepted.

5. Terminal blocks shall be clean and free of trimmed or cut-off copper pairs, sheaths, armors, cable lubricants or any other disposables used in the installation of the station cables.

6. All station cables shall be neatly dressed behind the terminal blocks in the IDF.

7. The backbone fiber optic cable system including all strands, connectors, termination shelves, fiber optic distribution panels, and fiber optic storage shelves has been installed and tested per these Specifications.

8. Do not install fiber optic cross-connects until after the backbone distribution cable test reports have been reviewed and accepted by the Owner.

9. All required submittals indicated in this Specification Section shall be made by the

Contractor, and any deficiencies or rejected submittals shall be corrected.

10. All specified fiber optic backbone cabling with associated termination components, splicing, labeling and testing shall be installed and completed properly. Any component not installed shall be inventoried and provided to the Owner in the manufacturer's packaging. Loose miscellaneous parts shall not be accepted.

11. The fiber optic termination shelves and the racks and floors around the shelves, shall be clean and free of trimmed or cut-off fiber optic strands, buffering, sheath and cable lubricants and any other disposables used in the placement and termination of the fiber optic backbone cables.

12. All innerducts and fiber optic backbone cables shall be neatly dressed into the pathways, communications vaults and vault racking.

13. Any deficiencies and punch list items shall be corrected.

14. All as-built documentation shall be complete, reviewed and provided to the Owner.

B. Acceptance of the telecommunications system by the Owner shall be based on the result of testing, functionality, and the receipt of documentation and warranty. With regard to testing, Contractor shall provide two technicians, equipped with the specified test equipment, to do random test verification in the presence of, and at the direction of, an Owner designated representative. Verification testing shall not exceed 20% of the cable plant, provided cables tested are verified to be 100% compliant, per requirements previously stated. If more than 5% of cables tested during the verification process fail, Owner reserves the right to have the entire cable plant retested, at the Contractor's expense, and in the presence of an Owner-designated representative.

3.11 RECORD DRAWINGS

A. The project record drawings shall show the types, locations and counts of installed:

1. Fiber optic cables and strands;

2. Fiber optic terminations counts and types.

B. The project record drawings shall show the types, locations, cable numbers and pair counts of installed twisted-pair cable:

1. Cable routing and numbers.

C. The project record drawings shall show the types and locations of installed equipment racks.

END OF SECTION 270000

SECTION 27 51 03

ASSISTED LISTENING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. All materials, labor, equipment, and incidentals necessary to install an FCC-compliant, ADA-compliant, FM-based, Stationary Assisted Listening System for wireless transmission of sound in the areas noted on the plans and as specified herein.

B. Provide a complete Assisted Listening System (ALS), including transmitter, receiver, headsets, and chargers for the locations indicated on the drawings and/or indicated by the Architect. Equipment for one example system is specified herein.

C. Any associated electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

D. It is the intent of the drawings and specifications that systems be complete and be ready for operation.

E. Provide CBC 2016 compliant seismic installation. See Section 26 05 00 for all certification and submittal requirements.

1.2 SUBMITTALS

A. Comply with the requirements of Section 26 05 00.

B. Provide submittals for the following equipment:
   1. Transmitter
   2. Receivers
   3. Charger
   4. Headsets

C. Equipment Manual: Furnish with the submittal, and with each unit delivered, an equipment manual that details the installation, operation and maintenance instructions for the provided equipment. Provide minimum (3) copies.

D. Spare Parts: Provide a list of customer-replaceable spare parts in the submittal. All spare parts shall be quickly and easily field-replaceable.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. The ALS shall be capable of broadcasting on 57 channels and be frequency agile.

B. The ALS system shall have 80dB SNR or greater, end-to-end. Receivers shall be frequency agile and frequency set with a "seek" button.

C. The receiver shall incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to audio normally.

D. The portable receivers and transmitters shall incorporate automatic battery charging circuitry for recharging of Ni-MH batteries.

2.2 ACCEPTABLE MANUFACTURERS

A. List of Equipment Manufacturers:
   1. Listen Technologies, or equal. All catalog numbers referenced in this specification are by Listen Technologies, unless otherwise noted.

2.3 PRODUCTS

A. Provide (1) transmitter base station with line level audio inputs. The transmitter shall have an easy-to-read front panel display to indicate output levels, channels, and related settings, and shall have push-button controls.
   1. Provide compatible audio cable for interconnection with A/V system.
   2. Catalog number: LT-800-072

B. Provide (1) rack mount kit with plexi-glass security cover.
   1. Catalog number: LA-326

C. Provide (1) universal antenna for mounting on ceiling, wall, remote base, or flexible dipole. If antenna is remoted, provide and install RG58 co-axial cable in 1” conduit for less than 100ft or RG8 co-axial cable in 1” conduit for more than 100ft runs (50 0hm).
   1. Catalog number: LA-122

D. Provide portable FM receiver units equal to 4% of the seating capacity plus (1), minimum of (3) units per system. Calculate per CBC 1004.5, Table 1004.5 (via CBC 11B-216.10).
   1. Each receiver shall have the following characteristics:
      a. Capable of being clipped to a pocket or belt.
      b. Include an on/off switch and volume control to adjust the output level as required by the listener.
      c. Easy-to-read channel label on the front face.
      d. Battery operated.
      e. Designed to allow battery recharging without removal from the receiver. Batteries shall be capable of being recharged with the charger/organizer.
      f. Shall include a 1/8" standard mono jack (CBC 11B-706.2).
      g. Shall be capable of providing a sound pressure level of 110dB minimum and 118dB maximum, with dynamic range on the volume control of 50 dB.
      h. Signal to noise ratio for the internally generator noise shall be 18dB minimum (CBC 11B-706.5).
      i. Peak clipping shall not exceed 18dB of clipping relative to the peaks of speach (CBC 11B-706.6).
   2. Catalog number: LR-400-072

E. Provide quantity of ear and neckloops equal to the number of receivers provided - 75% ear speakers, 25% neckloops.

1. Catalog number: LA-164 ear speaker.
2. Catalog number: LA-166 neckloop.

F. Provide charger device / storage container(s) to accommodate all of the provided equipment.
   1. Catalog number: LA-321 (8 unit model)

G. Provide Ni-MH rechargeable batteries.
   1. Catalog number: LA-362

H. Provide ADA Access/Compliance signage kit and coordinate placement with architect.
   1. LA-304

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to Section 26 05 00 for details of work under this section.

3.2 INSTALLATION

A. Locate transmitter adjacent to an available audio system input.

B. Audio input shall be taken from the audio system (provided in another section of work) via a standard line level stereo audio signal. Connect complete for full operation.

3.3 SYSTEM STARTUP

A. The Manufacturer shall provide a factory authorized technician to commission and confirm proper installation and operation of all system components.

3.4 TRAINING

A. Manufacturer shall provide factory authorized application engineer to train Owner personnel in the operation and programming of the Assisted Listening System. Provide (2) hours on-site training.

3.5 TESTING

A. Test for a complete and operational system after commissioning of ALS System.

B. Test each receiver at each selectable frequency, and at all probable usage locations within the area of intended use.

END OF SECTION

SECTION 28 31 00

FIRE ALARM SYSTEM WITH VOICE EVACUATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This project shall include the furnishing, installation, connection, programming, commissioning, and testing of new fire alarm equipment required to form a complete coordinated system ready for operation at the project. Equipment shall be networked if indicated on the drawings. The fire alarm system shall include, but not be limited to, alarm initiating devices, alarm notification appliances, voice evacuation system, control panel (with multiple panels at different buildings networked together where indicated on the drawings, auxiliary control devices, annunciators at each building, power supply extender panels (as required), amplifiers, and all associated wiring (fiber optic network and copper system cabling).

B. The system shall generally consist of a standalone fire alarm control panel with power supply extender panels and amplifiers at each building, or if indicated on the drawings a networked system with fire alarm control panels at each building, to control and operate all initiation and notification appliances at each building. The standalone fire alarm control panel shall include a digital dialer with off-site monitoring connection in order to identify the specific location of the control panel to the Fire Department. If a networked system is indicated on the drawings, each fire alarm control panel shall be identified for the specific building it controls and shall include a digital dialer with off-site monitoring connection in order to identify the specific building to the Fire Department. All panels at the facility shall be networked together in order to allow the central main fire alarm control panel (main FACP) to monitor each building on the site. Each building shall include a local LCD style annunciator. .

C. Alarms/troubles at each building shall activate the local notification devices (or report troubles) at the respective building panel only and report the alarms/troubles to the main fire alarm control panel, but shall not activate other building notification devices.

D. The system shall include an emergency voice evacuation alarm communication system. A digitized pre-recorded voice message shall notify occupants that a fire alarm condition has been reported. The message shall instruct the occupants with emergency instructions. All notification shall be speaker/strobes or strobe lights.

E. The work shall include all required programming to allow proper sequence and operation as required by code. Final programming shall be done based on the actual physical room names and numbers used on site, if different from the room names or numbers on the approved plans.

F. Provide CBC 2019 compliant seismic installation. See Section 26 0500 for all certification and submittal requirements.

G. All work shall comply with Sections 26 0500 and 26 2700.

1.2 SCOPE OF WORK

A. This specification outlines the requirements for a microprocessor based, addressable (intelligent) automatic fire detection and alarm system. The system and components shall be supplied by one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least five (5) years and who shall be able to refer to similar installations in public buildings rendering satisfactory service.

B. The work described in this specification consists of all labor, materials, equipment and services necessary and required to complete and program and test the automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on drawings but required for proper performance and operation shall be furnished, installed, and connected complete.

C. Where a networked system is indicated on the drawings, the work shall include all required programming to allow network operation between each control panel, for central monitoring from the Main FACP.

D. Final system programming (or re-programming for existing systems) shall be done based on the actual physical room names and numbers used on site, if different from the room names or numbers on the approved plans.

E. The contractor shall contact the local fire department and/or emergency communications authority to obtain local testing and acceptance criteria for emergency radio responder criteria.
   1. Contractor is to provide testing of the facility to ensure the entire structure meets approved radio coverage for emergency responders within the building. Coverage shall be in accordance with California Fire Code (CFC) section 510. Testing shall be coordinated with, and witnessed by, the local Fire Department, and shall be performed by a certified qualified technician as defined in section 510.5.2 of the California Fire Code. Testing shall be performed at a time when the building structure, including ceilings and walls, is judged adequately complete by the Fire Department.
   2. The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95% of all areas on each floor of the building meet signal strength requirements in sections 510 4.1.1 and 510 4.1.2 of the California Fire Code. Areas designated as vital, as determined by the Fire Department, shall have 99% coverage at signal strength required. Signal strength shall be measured on frequencies defined in section 510.4.2.2 of the CFC and as required by the Fire Department. Minimum signal strength of -95 dBm shall be receivable within the building and received by the agency's radio system outside the building, when transmitted from within the building.
   3. For passing tests, document the results of the test and submit with project close-out documentation.
   4. If the building/structure cannot support the required radio coverage, the Owner and the Architect shall be immediately notified, and a plan of action shall be put in place by the Owner and the design / construction team, for implementation of an

augmented amplification system as required by section 510.4.2 of the California Fire Code.

1.3 REQUIREMENTS

A. This installation shall be made in accordance with the drawings, specification and the following:
   1. National Electrical Code Article 760
   2. NFPA Standard 72
   3. Local Codes and Authorities Having Jurisdiction
   4. ADA requirements and regulations.

B. Fire Watch:
   1. Provide an AHJ approved Fire Watch plan and Fire Watch for any portion of the fire alarm system that is left inoperative in a normally occupied building.
   2. At no time during the project shall a normally occupied building, or portion thereof that remains occupied, be left without a functioning fire alarm system, unless an approved Fire Watch is provided.
   3. Include all required planning and labor for a Fire Watch, where required.

1.4 RELATED WORK

A. Division 26: Basic materials and methods

B. Division 21: Fire protection systems

C. Division 23: HVAC systems

D. Division 23: Fire Smoke Dampers

1.5 FIRE ALARM SYSTEM DESCRIPTION

A. The system shall be a supervised, non-coded, 24 volt DC, power limited system, networked if indicated on the drawings, and shall be capable of having all addressable initiation devices on the system in alarm at one time. Notification device circuits shall be wired Class B. Initiation device circuits shall also be wired Class B. A single ground or open on any initiating device circuit or notification appliance circuit shall not cause system malfunction, loss of operating power, or the ability to report an alarm.

B. Provide initiation, notification and other devices as per specifications and indicated on drawings.

C. Indicate alarms, supervisory, and trouble signals on the main fire alarm control panel and annunciator at each building and at the building fire alarm control panel in a networked system.

D. Initiate signals to control (shut-off) HVAC system units and FSD's as per drawings and as required by code.

E. Transmit alarm signals to off-site reporting agency via a digital communicator at each fire alarm control panel, with specific building address ID.

F. The fire alarm system shall function as follows when any smoke or duct detector, waterflow switch, manual station or other initiating device operates:
   1. Operate required audible/visual and visual devices indicated on the drawings.
   2. Automatically notify off-site reporting agency.
   3. Indicate at the control panel alphanumeric display the number and location of the alarmed device.
   4. Light an indicating lamp on the smoke detector initiating the alarm.
   5. Light an indicating lamp on the remote annunciator indicating the location alarmed as well as the type of device alarmed (area smoke detector, duct detector, manual pull station, waterflow switch, kitchen fire suppression system panel, valve supervisory switch, etc.).

G. Provide additional system features and capacities as indicated in Part 2 of this Section of the Specifications.

1.6 GUARANTEE

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

1.7 SUBMITTALS

A. Submit fire alarm shop drawings and product data sheets in accordance with Division 1 and Section 26 05 00.

B. This Contractor shall submit the completed Fire Alarm Shop Drawings, with associated equipment cut sheets and CSFM listings, to the local Fire Department and submit for a separate Fire Alarm System Permit as required by the local authority. Final Fire Alarm System approval (by the AHJ) and Permit shall be based on the shop drawings submitted and completed by the Contractor. The design drawings are for overall system requirements and layout only.

C. Shop Drawings shall indicate the following: building floor plan, location and type of devices, conduit and wire quantities, power requirements, complete wiring point-to-point diagrams, details, and locations of fire alarm and remote annunciator panels. Submittal shall include a system 1-line riser diagram with all devices and equipment and interconnections shown.

D. Submit manufacturer's installation instructions including back-box requirements for each piece of equipment.

E. Submit manufacturer's operating instructions and maintenance data.

F. Submit voltage drop and battery calculations.

1.8 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification.

A. National Fire Protection Association (NFPA) - USA:

No. 70	National Electrical Code (NEC)
No. 72	National Fire Alarm Code
No. 101	Life Safety Code

B. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 1971	Visual Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 346	Waterflow Indicators for Fire Protective Signaling Systems

C. Local and State Building Codes.

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.9 APPROVALS

A. Fire alarm control panels and all peripherals shall have proper listing and/or approval from Underwriters Laboratory (UL) and be California State Fire Marshall listed and approved.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new, and the manufacturer's current model.

B. The system shall be UL 864 (9th Edition) listed.

C. Acceptable System Manufacturers:
   1. New systems; Notifier, no exceptions. To match existing at campus.

D. All equipment and components shall be installed in strict compliance with manufacturers' recommendations.

E. All Equipment shall be attached to and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT, BOXES, AND WIRE

A. All conduit and wire shall comply with section 26 27 00 of these specifications.

B. Conduit:
1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
4. Conduit shall be 3/4 inch minimum.

C. Wire:
1. All fire alarm system wiring shall be new and installed in conduit. All wiring shall be in conformance with fire alarm system manufacturer's requirements.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760). Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 16 AWG for initiating device circuits and signaling line circuits, and 12 AWG for Notification device circuits.
3. All field wiring shall be completely supervised, Class B for initiation loops, and Class B also for notification loops with end-of-line devices located as shown on the riser diagram.
4. If indicated on the drawings, Class A loops shall be used for initiation circuits, and shall always include a return cable to the fire alarm panel terminals, per Class A and manufacturer's wiring requirements.
5. All cable used in conduit outdoors or underground shall be Outside Plant Rated.
6. Network communications loop shall be a 50/125 multi-mode fiber optic outside plant cable installed in inner-duct in the fire alarm site conduit and shall link all control panels if networked system is indicated on the drawings.

D. Terminal Boxes, Junction Boxes and Cabinets:
1. All boxes and cabinets shall be UL listed for their use and purpose.
2. Outlet boxes for surface mounting shall be fire alarm listed use boxes with exactly the same size of the device. Standard galvanized outlet or j-boxes are not acceptable.

E. Each Fire Alarm Control Panel and expander panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the power panel as FIRE ALARM and include a breaker handle lock for the dedicated breaker. Fire alarm control panel primary power wiring shall be #12 AWG. The control panel cabinet shall be properly grounded.

2.3 CONTROL PANEL

A. The control panel shall be microprocessor based and totally power limited. The panel shall be capable of supporting Class A (Style 6) or Class B (Style 4) Network Communications lines, and Class A (Style Z) or Class B (Style Y) Notification Circuits. The panel shall have the following features; Totally Field Programmable, Password Access Protection, Built in Panel Diagnostics, Alarm and Trouble Resound, Alarm Event Buffer, Trouble Status Buffer, Point Identification Display, 24 hour Trouble resound, One Man Walk Test, Alarm Verification, and Positive Alarm Sequence. The panel (and expander panels where required) shall include audio amplifiers and related components to support the voice evacuation requirements. The panel shall have the following relays with a form C configuration; Alarm, Trouble, Supervisory, and Default Alarm Mode (to allow alarm reporting during microprocessor failure).

B. The control panel shall be designed to monitor and process a minimum of 159 addressable inputs (smoke detectors, manual stations water flow devices, etc.), and up to 159 addressable monitor or control modules. The Network Communication Lines shall support various annunciation devices (i.e. LED Annunciators, Alphanumeric Displays, Printers) in addition to the addressable inputs and outputs described above. The system architecture shall allow for T-tapping of the Network Communications Lines. The use of a Zone Monitor module on the Communications Line shall further enhance the system with a master/slave concept, allowing a group of conventional detection devices (standard smoke detectors manual stations, waterflow and tamper switches) to be interfaced into the system as an address point. The system shall include individual power supply expander panels as required to support the notification loops. Each notification circuit shall be independently field programmable by the use of addressable control modules rated for the required current.

C. The control panel shall contain an Alphanumeric Display interface which contains a microprocessor with a non-volatile memory to store field programmable alarm and trouble messages. The Alphanumeric Display shall consist of two 40 character lines for alarm, supervisory and trouble identification, and in quiescent mode, indicates system status.

D. The control panel shall have history reporting, with the history stored in either the alphanumeric or printer modules. The history shall be at least 1,000 events. These events can be alarm, verification, supervisory, trouble, acknowledge, system reset, walk test, and the use of any panel keypad keys and access to any panel modes such as Program or Test.

E. The control panel shall have self-diagnosis. Once the program is stored in memory and upon system initiating, if there is a discrepancy between the number of devices entered into the program and the actual number of devices connected to the system, the panel shall annunciate a trouble for the devices in question.

F. Power Supply
   1. The Power Supply for the Fire Alarm Control Panel may be integral or external to the Fire Alarm Control Panel, and shall provide all control panel and peripheral

device power needs. Additional power required to operate all alarm devices (above and beyond the capacity of the main panel supply) shall be provided with power expander panel(s), connected to the alarm output of the main control panel. Provide all required interface modules and relays for proper notification circuit operation as per manufacturer's instructions. Expander panel shall be as manufactured by the chosen Fire Alarm System manufacturer (qty. as required for full alarm operation).

2. Input power shall be provided at 120 VAC, 60 HZ. The power supply shall provide an integral battery charger for use with a minimum of 12 AH batteries.
3. It shall provide a minimum of 6.0 amperes of regulated 24 VDC power for Audio-Visual alarm notification devices, 200 mA of smoke detector power, and 200 mA of Non-Resettable power.
4. The power supply shall be designed to meet UL and NFPA requirements for power-limited operation on all initiating and notification circuits.
5. Positive-temperature-coefficient thermistors, circuit breakers, fuses, or other over-current protection shall be provided on all power outputs.

G. Mechanical Design: The control panel shall be housed in a cabinet designed for mounting directly to a wall or vertical surface. The back box and door shall be constructed of .060 steel with provisions for electrical conduit connections into the sides and top. No conduit penetrations shall be utilized on the back or bottom of the panel. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. The cabinet shall be approximately 5 inches deep and 14.5 inches wide. Height shall be approximately 16 inches.

H. The control panel shall have the exact model number and manufacturer's name indicated on the front panel cover.

2.4 INITIATION DEVICES

A. Addressable photoelectric smoke detectors, (intelligent), shall be provided as indicated on the drawings, with features and characteristics as follows:
1. The detector shall be self-compensating for ambient temperature and humidity.
2. The detector shall be addressed, tested and programmed prior to installation using a UL listed programmer/tester. The detector readout shall yield a discrete electrical value for status tracking and logging for determining maintenance and cleaning requirements.
3. The detector shall be suitable for two wire operation and two way communication on the intelligent analog signaling circuits.
4. The detector shall display a flashing red LED when in the alarm state when the system is operating from normal or standby power.
5. The detectors furnished shall be listed for use in environments as covered by Factory Mutual, UL and shall be installed according to the requirements of NFPA 72 for open area coverage.
6. Detectors for magnetic door hold open functions shall be provided with an auxiliary relay base for auxiliary function wiring connections.
   a. Door holder power shall be routed via the relay base on smoke detectors denoted with an "R" to release the associated doors upon alarm.

B. Heat detectors shall be provided as indicated on drawings. Heat detector shall be of the rate compensation type, 135 degree.

C. Duct Detectors:
   1. Duct detectors for air-handling units, complete with all required sampling tubes and housings, shall be provided and connected complete by this contractor, installed by Division 23. Coordinate with Division 23.
   2. Duct Detectors shall be connected to the air handler starter unit, in order to facilitate unit shut-down upon alarm (via an auxiliary relay in the duct detector). Coordinate exact control wiring with Division 23. Provide and install all required wiring and conduit for starter/duct detector interface.
   3. Provide and install power connection to each duct detector as required. Coordinate with Division 23.
   4. Provide Nema 3R exterior rated housings for all exterior duct detectors.

D. Manual stations, (intelligent), shall be single action and semi-flush or surface mounted as indicated on the drawings.
   1. The manual station shall be equipped with a terminal strip and pressure style screw terminals for the connection of field wiring.
   2. The manual stations shall be addressable and identifiable by the fire alarm control panel when they are resident on the analog loop. Address programming shall be accomplished electronically and reside within the station in non-volatile memory.

E. A monitor module interface device shall be provided for required interface points such as water flow devices and tamper switches, or any contact type devices as indicated on drawings. This interface device shall have one or two Class B (Style 4) circuits as required.

F. Provide a 120VAC circuit connection to each sprinkler system water flow bell (provided by Division 21). Wire power via the local water flow switch auxiliary contact to ring the bell upon water flow activation.

2.5 BATTERIES

A. Batteries shall be 12 volt, sealed type, with combined Amp-Hour ratings as required by Code.

B. Battery shall have a minimum sufficient capacity to power the fire alarm system for not less than twenty-four hours in standby mode, plus 15 minutes of full system alarm upon a normal AC power failure.

C. The batteries are to be completely maintenance free, no liquids required. Fluid level checks, refilling, spills and leakage control shall not be required.

2.6 CONTROL DEVICES

A. Control modules shall be provided as indicated on the drawings for fire alarm output functions. These devices shall be connected to the Network Communications Lines, and be field programmable for one of the following options; Remote Relay (form C 1amp 24vdc, 200ma 120vac) with supervised relay operation; Remote Supervised

Indicating Appliance Circuit (fused at 1 amp). There shall be an LED on the device that shall flash to indicate the unit is being monitored and a steady LED to indicate the unit has been activated. Secondary relays with control power connections shall be provided as required where contact ratings (voltage & amps) so dictate.

2.7 NOTIFICATION DEVICES

A. Speaker / Strobe Notification Devices:
   1. All speakers shall operate on 70.7 VRMS, with field selectable output taps from 1/8 to 2 Watts in 3dB steps. Frequency response shall be a minimum of 400 HZ to 4 KHZ.
      a. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements. All speaker tap settings shall be set per recommended settings (minimum 1/4 watt) for area coverage, and shall be re-tapped as required after final testing to provide adequate audible coverage throughout each area (to meet NFPA requirements).
      b. Speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
      c. Provide amplifier modules as required to carry the full designed load, plus 20% spare capacity. Provide (1) additional back-up amplifier module for automatic back up of any failed amplifier module.
      d. Speaker/Strobe combinations shall be provided as indicated on Drawings. The speaker / strobe combination shall be Wheelock or equal, ADA and UL 1971 compliant (candela values as required) - white finish.

B. Strobe Lights shall be provided as indicated on drawings. The strobe lights shall be either ceiling mounted, or wall mounted at +80" AFF or 6" below the ceiling level, whichever is lower, Wheelock or equal, ADA and UL 1971 compliant (candela values as required) - White finish. See drawings for locations.

C. All devices in the gymnasium, multipurpose and locker rooms shall be provided with clear protective covers for vandalism protection. Provide protective covers as recommended by the manufacturer.

D. Refer to Part 3 below for required synchronization of strobes when located in the same field of view.

2.8 FIRE / SMOKE DAMPER

A. Fire / Smoke dampers (FSD's) are provided and installed by Division 23. This contractor shall provide and install a 120V power connection to each damper, wired to keep the damper in the open position under normal conditions.

B. An integral duct smoke detector shall be provided by Division 23. This contractor shall provide and install an addressable monitor module, connected to the alarm contacts on the duct detector, to monitor the condition of the detector and annunciate an alarm condition to the main control panel upon detection of smoke.

C. This contractor shall wire the 120V control power for the FSD's via an auxiliary alarm contact in the detector base, to automatically close the damper upon smoke detection. Coordinate all provisions with Division 23.

D. All FSD provisions shall comply with the applicable sections and requirements of the CEC, CFC, CBC and the local AHJ.

E. Every effort has been made to indicate all required damper locations at rated partitions in coordination with Division 23 work. This contractor shall coordinate with the sub-mechanical contractor to identify all required locations for FSD's and provide connections to all units as required by Code. The architectural drawings indicate by symbol, all such rated partitions. No extra cost shall be approved for additional required connections not shown on the drawings.

2.9 AUDIO AMPLIFIERS

A. The Audio Amplifiers shall provide audio power at 70.7 Volts RMS for distribution to speaker circuits.

B. Multiple audio amplifiers shall be mounted in the FACP, or at the FACP or expander panel locations, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).

C. The audio amplifiers shall include an integral power supply, and shall provide the following controls and indicators:
   1. Normal Audio Level LED
   2. Incorrect Audio Level LED
   3. Brownout LED
   4. Battery Trouble LED
   5. Amplifier Trouble LED

2.10 AUDIO AMPLIFIER GAIN ADJUST

A. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.

B. Amplifiers shall include audio input and amplified output supervision; back up input, and automatic switch over function, (if primary amplifier should fail).

C. Amplifiers shall be backed up in groups (1 amplifier backs up several at the same location). Failure of any one amplifier in the system shall not degrade system performance in any way

2.11 AUDIO MESSAGE GENERATOR (PRERECORDED VOICE)

A. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.

B. Activation of any alarm-initiating device shall cause a prerecorded message to sound over the designated speakers. The message shall be repeated a minimum of four (4) times.

C. A built in microphone shall be provided to allow paging through speaker zone circuits.

D. The audio message generator shall have the following controls and indicators to allow for proper operator understanding and control:
   1. All Call LED
   2. On Line LED

E. All Call Switch Local Speaker Volume Control Local (Test) Speaker

2.12 SPEAKER CIRCUIT CONTROL SWITCHES / INDICATORS

A. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.

B. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation, programming and testing shall be performed by current factory-authorized contractor of the specified system.

B. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

E. Provide identification labeling on all initiation and notification devices to identify loop and device number/address. Labeling shall consist of min. 3/8" black lettering on white background P-Touch style adhesive labels with machine printing, Helvetica font or similar.

F. At the final inspection a factory trained representative of the manufacturer of the major equipment shall perform the tests in Section 3.3 TESTING.

G. Wiring:
   1. See Part 1 of this Section of the Specification and the drawings for wiring requirements.

2. When (3) or more visual notification devices are located within the same field of view and are less than 55 feet apart (within the field of view), all devices within that field of view shall be synchronized to provide the same flash rate and frequency. Provide all required sync modules and compatible strobe devices to provide a synchronized output.

3.2 PROGRAMMING

A. Provide system programming as required by code to provide a fully functional system. Final programming shall be done based on the actual physical room names and numbers on site, if different from the room names or numbers on the approved plans.

B. Include changes to existing system programming (if existing), to accommodate the new devices and equipment, as well as any sequence of operation changes.

C. When the device address(es) shown on plan is already programmed to an existing device, use another available address and show any changes or revisions on the as-built drawings during the project closeout.

3.3 TESTING

A. Refer to Scope of Work in Part 1 of this section for required emergency radio responder system testing requirements and documentation.

B. Provide the service of a competent, factory trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Each building shall be separately tested as completed and where a networked system is indicated on the drawings, the entire networked system tested just prior to project completion. Include contractor pre-test for each building prior to the final AHJ testing to insure a suitable final test result.
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Close each sprinkler system flow valve and verify proper supervisory alarm at the respective FACP and/or annunciator.
   3. Verify activation of all flow switches.
   4. Open initiating device circuits and verify that the trouble signal actuates at the respective FACP and/or annunciator.
   5. Open and short all notification appliance circuits and verify that trouble signals actuate at the respective FACP and/or annunciator.
   6. Ground circuits and verify response of trouble signals at the respective FACP and/or annunciator.
   7. Check presence and audibility of tone at all alarm notification devices.
   8. Check installation, supervision, and operation.
   9. Verify that each initiating device alarm is properly received and processed by the respective FACP and annunciator (Walk Test).
   10. Conduct tests from each FACP to verify trouble indications for common mode failures, such as alternating current power failure.

C. Test reports shall include, but not be limited to:
   1. A complete list of equipment installed indicating proper operations as listed above.
   2. Point print of all devices connected to all the FACP's.

3.4 FINAL INSPECTION

A. Final acceptance will require the contractor to deliver to the Owner the following;
   1. A single bookmarked PDF file of the operating instructions and system maintenance manuals.
   2. A single bookmarked PDF file of record drawings.
   3. A single bookmarked PDF file of the final test reports.
   4. A single bookmarked PDF file indicating the name and phone number of person to contact in the event of equipment failure, and date when system warranty will be terminate.
   5. A single bookmarked PDF file of data sheets for each piece of equipment supplied.

B. The fire alarm system notification audibility and intelligibility shall be tested and approved prior to final acceptance. Verify that all occupied spaces in the buildings are provided with adequate audibility and intelligibility of the temporal 3 alarm tone and voice evacuation recorded message. Test to be conducted in the presence of the IOR, who will provide acceptance of test outcome. Provide, install, and test additional alarm devices as required, if any deficiencies are noted.

3.5 GUARANTEE

A. See Part 1 of this Section of the Specifications.

3.6 INSTRUCTION

A. Provide complete instruction manuals and training to the building personnel. "Hands-on" demonstrations of the operation of all system components and the entire system shall be provided.

END OF SECTION

SECTION 31 10 00

SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Locate and mark existing utilities within the limits of work.

2. Remove all existing structures, surface and subsurface improvements within the area indicated, except for existing underground site utilities as indicated on plan.

3. Install and maintain tree protective fencing around trees to be saved and remove all existing trees within the limits of work except those designated to remain.

4. Properly dispose of all unsuitable material.

5. Strip all areas within the limits of work.

6. Relocate existing utilities as indicated to maintain service.

7. Deploy and subsequently remove temporary construction area fencing at completion of construction.

8. Obtain and pay for encroachment permit for work on the public water line on the Southwest corner of the project.

B. Related Sections:

1. Earthwork - Section 31 20 00

2. Trenching, Backfilling and Compaction - Section 31 23 16

1.2 REFERENCES

A. Reference Data:

1. If the year of the adoption or latest revision is omitted from the designation, it shall mean the specification, manual or test designation in effect the date the Notice to Proceed with the work is given.

B. City of Napa Standard Plans and Specifications.

C. Caltrans Standard Plans and Specifications, where applicable.

PART 2 - PRODUCTS

2.1 CLEARED MATERIAL

A. The unsuitable cleared material including structural fragments, broken concrete, asphalt, underground utilities, and other similar debris, shall be completely removed from the project site and disposed of properly.

B. Certain improvements as designated on the plan shall be carefully removed and returned to the owner's maintenance facility.

2.2 STRIPPED MATERIAL

A. Objectionable stripped material shall be removed from the project site and disposed of properly.

2.3 EROSION CONTROL

A. All materials shall be as shown on the plans.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Install tree protective fencing around trees designated to be saved prior to the start of demolition work. See Landscape Plans and Specifications. Install fencing as far from the trunk as possible to allow for construction of proposed improvements. Maintain fencing throughout duration of construction.

B. The area above the natural ground surface shall be cleared of all vegetable growth such as trees not designated to be saved, roots, brush, grass and weeds and all other objectionable material including concrete, masonry, sheet metal, lumber, retaining walls, utility enclosures, guardrails and similar materials within the limits of construction.

C. The natural ground surface within the entire site, except within the tree protection zones, shall be grubbed to a depth necessary to remove all stumps, buried logs, roots over 2-inches in diameter and all other unsuitable material. Stumps shall be removed to a depth of at least 24" below original grade.

D. Existing utilities to be abandoned that are located within the limit of work line shall be removed.

E. All unsuitable material shall be removed from the construction area and disposed of properly. Comply with hazardous materials abatement regulations that may apply.

F. Certain improvements designated on the plan shall be carefully removed and shall be returned to the owner's maintenance facility.

3.2 DEMOLITION SEQUENCING

A. The Owner has strict utility outage limitations that will require careful sequencing of the demolition and construction work. Acceptable shutdown times are typically Friday through Sunday and must be specifically approved in advance by the Construction Manager and the college. Permanent and/or temporary facilities may need to be installed prior to demolition to limit utility outages. Any planned and or necessary interruption of existing utilities shall be coordinated with the Construction Manager. A minimum of one week's notice shall be provided before any such interruption.

3.3 STRIPPING

A. The upper soils containing grass, small roots and other vegetation to a depth of 2-3 inches shall be stripped from and removed from the site. Deeper stripping may be required in localized areas to remove roots or other concentrations of organic material.

B. Dust control shall be performed by the contractor during all phases of the construction. Payment for the dust control work involved shall be considered included in the various other items of work and no additional allowance will be made therefor.

C. The Geotechnical Engineer will observe the clearing and stripping operations and recommend the maximum depth of stripping required and any additional excavation necessary due to contamination of materials or concentrations of vegetation.

D. All suitable stripped material in excess of those needed to backfill planter areas shall be removed from the project site and disposed of properly.

3.4 EROSION CONTROL

A. Install and maintain filter fabric wrapped grates, sediment rolls, both silt fence wrapped and plain, around inlet structures until such time as all vegetative and hard surface improvements within their individual tributary areas are completed. Provide periodic maintenance of all such devices, and following completion of said improvements, remove and dispose of erosion control devices and repair surfaces to match final specified surface finishes.

B. Any areas where ground has been disturbed, and where final landscaping has not been installed by October 15 will require the installation and maintenance of erosion control devices by the Contractor, as generally shown on the plans.

C. Install and maintain "True Dam" silt barriers at curb inlets as required. Remove following completion of hard surface and vegetative improvements with individual tributary areas.

3.5 SURFACE IMPROVEMENT AND UTILITY REMOVAL AND RELOCATION

A. The Contractor shall have Underground Service Alert mark all existing public utilities as a first order of work. Additionally, the contractor shall have a locating service mark all existing private utilities within the limits of work.

B. The Contractor shall pothole each existing utility that will be extended or reused at its point of cut and removal to confirm the actual locations and depths. Notify engineer of results.

C. Existing water, sewer, storm drain, gas, electrical, communication (data) services and mains to be abandoned and removed as indicated on the plans. Comply with construction sequencing requirements to limit utility outages as required by the owner.

D. All concrete and asphalt pavements and other existing improvements within the areas to be developed should be removed during site demolition. Existing building foundations should be entirely removed below final subgrade in the new building areas, and to a depth of at least three feet in areas outside the new building footprints. The excavations beneath the planned building area should be backfilled with engineered fill. See also Section 31 20 00.

E. The existing asphalt concrete pavement may be ground up and used in the fill, provided it is acceptable from an environmental standpoint. The asphalt and concrete should be broken into fragments smaller than three inches in greatest dimension and mixed with soil to comprise less than 20 percent by weight of the fill; a higher percentage may be difficult to compact.

F. See Mechanical, Electrical, and Civil plans for detailed removal/replacements requirements.

3.6 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

END OF SECTION

SECTION 31 10 01

PLANT PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Preserve and protect existing trees, shrubs and other plant materials to remain, including protecting plants on adjoining properties during site preparation work and construction.

B. Provide tree and shrub pruning and removal in accordance with these Specifications if required by the Contract Documents.

C. Layout and review of utility and irrigation trenches that occur in the Tree Protection Root Zone.

D. Related requirements specified elsewhere include:
   1. Section 31 00 00, EARTHWORK
   2. Section 32 84 00, IRRIGATION
   3. Section 32 90 00, PLANTING

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. Ordinances and Regulations: All local, municipal and state laws, codes and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the above codes, regulations or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship or construction of a better quality, higher standard than is required by the above-mentioned codes and regulations, the provisions of these Specifications and Drawings shall take precedence. Furnish without extra charge additional materials and labor required to comply with above rules and regulations.

   2. International Society of Arboriculture, Guide for Plant Appraisal, latest version.

B. Pre-installation Conference:
   1. Conduct conference at the project site. Contractor shall review and identify with the Owner’s Representative the limits of Work and extent of plant materials and other improvements to be protected. Notify Owner's Representative of discrepancies between existing conditions and Drawings before proceeding with Work.
   2. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Tree-service firm's personnel, and equipment needed
      b. Arborist's responsibilities.
      c. Quality-control program.

d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.

C. At the Owner's discretion, an Arborist may represent the Owner to review the work of the Contractor in regard to plant protection. Arborist Qualifications: ISA Certified Arborist licensed to work in the State of California.

D. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

1.3 PROJECT CONDITIONS

A. Coordination: Coordinate this work with the work of other Sections to avoid delay and interference with other work.

B. Nuisances: Keep dirt, dust, noise and other objectionable nuisance to a minimum. Use temporary enclosures, coverings and sprinkling, and combinations thereof, as necessary to limit dust to lowest practicable level, except do not use water to the extent that it causes flooding or contaminated run-off.

C. Traffic: Conduct work to ensure minimum interference with vehicular and pedestrian traffic, and to permit unencumbered access to site and adjacent properties.
1. Do not close or obstruct streets, sidewalks, alleys or other public passageways without permission from authorities having jurisdiction.
2. If required by governing authorities, provide alternate routes around closed and obstructed traffic ways.

D. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Excavation or other digging unless otherwise indicated.
6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

E. Do not direct vehicle or equipment exhaust toward protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

1.4 DEFINITIONS

A. Diameter at breast height (DBH): diameter of a trunk as measured at a height 54 inches above the ground line.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

C. Tree-Protection Zone (TPZ): Area surrounding individual trees or groups of trees to be protected during construction and as identified on the Drawings or otherwise by a certified arborist.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

E. Structural Root Zone: A circular area with the tree trunk at the center and a radius equal to 3 times the diameter of the tree trunk measured at breast height (4.5 feet above ground line). Any structural (buttress) root, which has been severed or is rotten within this zone, can no longer provide adequate support to the tree and must be considered missing.

F. Dripline: The area of the ground directly beneath the vertical projection (shadow) of the tree's foliage canopy.

1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Soil Analysis Report:
1. Provide soil analysis report for any top soil to be removed and stockpiled for reuse as planting soil. Soils analysis report to be performed by a certified soil analysis laboratory, and include horticulturall suitability analysis and recommendations for amending the soil. Subsoil will not be approved as planting soil.

C. Samples: For each type of the following:
1. Organic Mulch: 1-quart of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Planting Soil: 1-quart of soil; in sealed plastic bags; for soils to be used within the protection zones.

D. Shop Drawings:
1. Include plans and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones. Indicate extent of trenching by hand or with air spade within protection zones.

E. Qualification Data: For arborist and tree service firm.

F. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

G. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

H. Survey of Existing Conditions: Provide to Owner a Survey of Existing Conditions. Record existing conditions, including underground utilities, etc. on As Built

Drawings by use of field measurements and preconstruction photographs. Make permanent record of measurements, materials, and construction details required to make exact reproduction.

I. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.
   4. Description of pruning to be performed.
   5. Description of maintenance following pruning.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Approved planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
   1. Type: Wood and bark chips
   2. Size Range: ½’-2”
   3. Color: Natural Brown.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:
   1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts; with 1-5/8-inch- OD top and bottom rails; with tie wires, hog ring ties, and other accessories for a complete fence system.
      a. Height: 72 inches
   2. Gates: Swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:
   1. Text: “Tree Protection Zone. No Heavy Equipment.”
   2. Lettering: 3-inch- high minimum, black characters on white background.

E. Tree Branch & Trunk Protection: for branches trunks exposed to, or at risk of exposure to impact by construction equipment.
   1. 2x lumber
   2. 1/2”-wide steel straps

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas in which work is to be performed. Report in writing to the Owner's Representative all prevailing conditions that will adversely affect the existing plant materials to remain. Do not proceed with work until a solution acceptable to the Owner's Representative has been arrived at.

B. Survey of Existing Conditions: Record existing conditions, including underground utilities, etc. by use of measured drawings and preconstruction photographs.

C. Starting work constitutes acceptance of the existing conditions and the Contractor shall then, at his expense, be responsible for correcting all unsatisfactory and defective work encountered.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain and/or be relocated. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
   1. Apply 4-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

D. Install and maintain temporary fencing and other required protective devices and exclude construction activities from tree/shrub zones except as supervised by the Arborist / Owner's Representative.

E. If tree/plant protection zones cannot be protected with fencing, a four-inch layer of mulch with minimum 1.25-inch-thick, metal strap linked plywood shielding shall be maintained in the tree/shrub zone where heavy equipment will be operated.

3.3 PROTECTION ZONES

A. Protect trees and shrubs against cutting, breaking, skinning and bruising of bark; permit no traffic or stockpiling within drip line.

B. Do not change earth surface within drip line of trees and shrubs except as approved in writing by the Owner.

C. Do not park vehicles or store materials, supplies and construction equipment within Tree Protection Zone.

D. Verify details of protection-zone fencing before retaining last option in "Protection-Zone Fencing" Paragraph below.

E. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
   2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to the Landscape Architect. Post may be steel driven type, or self-supporting type.
   3. Access Gates: Install where required; adjust 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.

F. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by the Landscape Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, with signs each facing a different direction.

G. Where tree branches & trunks are exposed to, or at risk of exposure to impact by construction equipment, secure 2x lumber radially around tree branches and/or trunk to prevent damage. Secure lumber with steel strapping.

H. Maintain protection zones free of weeds and trash.

I. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
   2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION & TRENCHING

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut

main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Retain first paragraph below to limit damage to roots of valuable trees or delete if not required. Procedure is expensive.

D. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

E. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as approved by certified arborist.
   1. Generally cutting of roots two inches or greater shall be avoided. Roots one inch and greater in diameter that must be cut shall be cut cleanly and obliquely with the cut surface facing down.
   2. Exposed and pruned roots shall be covered with light well-drained soil backfill and mulch over. The area shall be kept moist. Retain applicable subparagraphs below.
   3. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
   4. Cut Ends: Do not paint cut root ends
   5. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   6. Cover exposed roots with burlap and water regularly.
   7. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 AIR SPADING:

A. Air spading, or hand removal of soil or tunneling is required for excavation in the Tree Protection Zone of any trees for the installation of infrastructure where roots

2 inches in diameter and larger are encountered. The “critical root zone” is defined as any area around a tree in which a two-inch diameter root is encountered. The Arborist / Owner’s Representative shall define the critical root zone and the Contractor shall excavate using a pneumatic excavator (AIR-SPADE or equivalent) as follows:

B. Trenching for utility lines or other infrastructure may be done mechanically outside the Tree Protection Zone. As the equipment operator approaches the canopy radius, or for certain species up to 1.5 times the canopy radius out from the base of the tree (Oaks, Poplars, Redwoods, etc.) the operator shall be assisted by a spotter who shall inspect the excavation for roots. If a root of two inches diameter is encountered the spotter shall halt mechanical excavation and pneumatic excavation shall proceed. If no other two inch or greater diameter root is encountered in an excavation of two feet forward and two feet deep, the single two-inch root may be cleanly cut proximal to (on the tree side of) any fracture or torn bark. Mechanical excavation may continue until a two-inch diameter root is encountered, and the pneumatic excavation, exploration is then repeated.

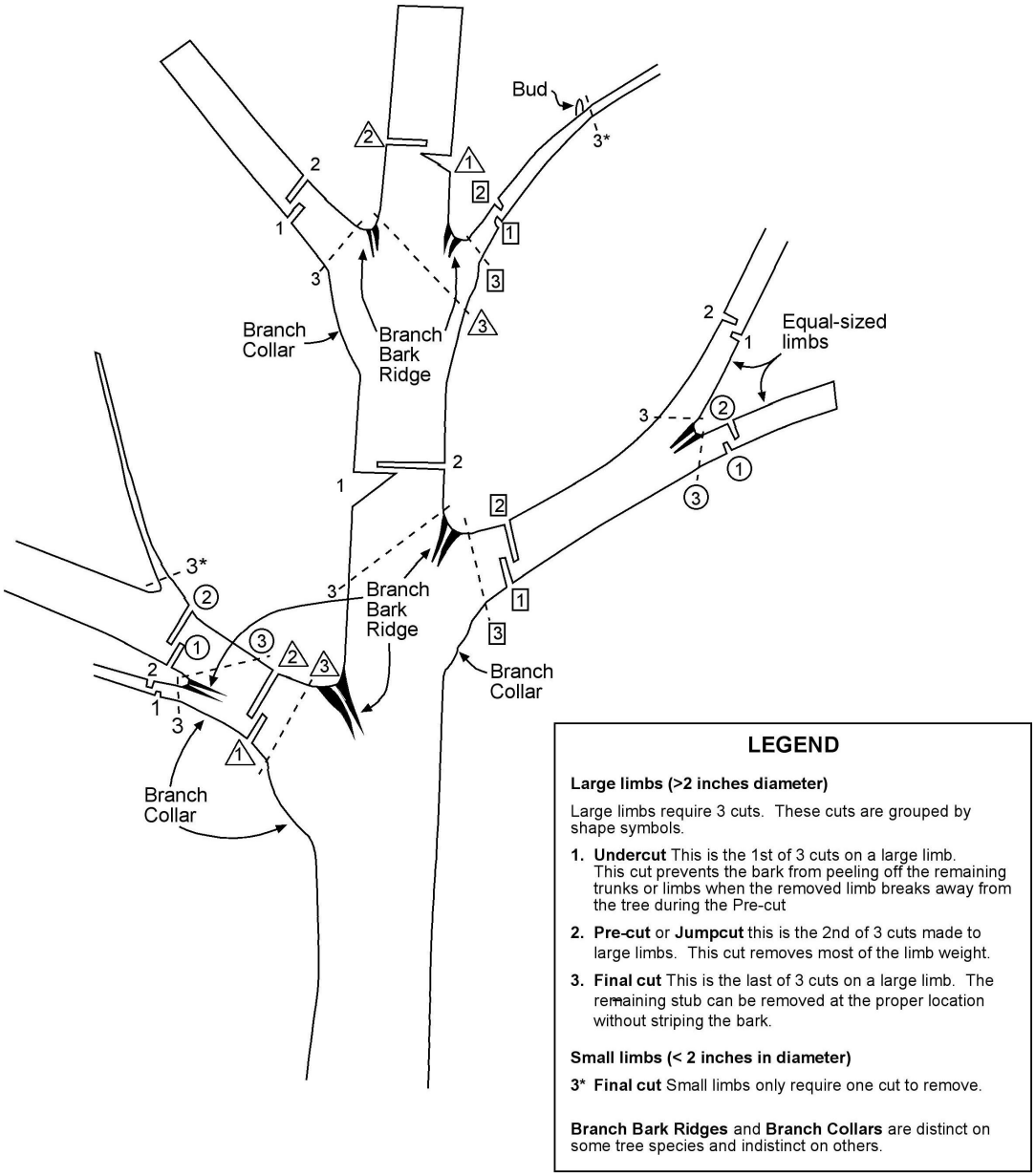
C. The Contractor shall control dust and the spread of soils excavated. The air-spade operator shall moisten the soil to field capacity and to a minimum probe depth of 2.5 feet with a watering needle (hydro-spear) 48 hours prior to pneumatic excavation. The spread of excavated soil shall be contained to the area adjacent to the trench path with upright plywood sheeting.

D. These specifications shall not be considered operating instructions or a requirement to use a specific pneumatic excavation product. It is the responsibility of the Contractor to read and understand the pneumatic excavator operation instructions and safety procedures (including the proper and safe use of air compressor, hoses, excavation tools, etc.) prior to operations.

3.7 TREE PRUNING

A. Obtain specific instruction from Arborist / Owner's Representative for pruning of trees, shrubs, roots or disturbance of soil within spread of tree branches. The Contractor shall utilize protection measures as outlined by Arborist / Owner's Representative, which may include directional drilling, or hand clearing to expose the roots.

B. Provide periodic watering for all planting within Contract limit and any adjacent areas affected by the work. Maintain moisture to a minimum 6" depth, minimum.



C. Using an approved pruning saw, provide selective tree limb pruning as accepted by the Landscape Architect if branches interfere with new construction. Limb diameter shall be limited to 5” diameter and shall be pruned just outside the branch collar in accordance with American National Standards Institute, (ANSI 300) and International Society of Arboriculture, (ISA) standards.

D. Approved branches to be shortened must be cut just above a fork with another living branch which is plus or minus 1/2 the diameter of the removed branch as

shown in the pruning figure herein. Branches to be removed which exceed 2" in diameter shall be severed with a 3-step cut to prevent bark peeling. Final cuts must not injure the branch collar or branch bark ridge of the remaining branches and trunk.

E. Prune branches that are affected by temporary and permanent construction.
   1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
   2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
   3. Pruning Standards: Prune trees according to ANSI A300 (Part 1)

F. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

G. Cut branches with sharp pruning instruments; do not break or chop.

H. Do not paint or apply sealants to wounds.

I. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

3.8 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

C. Minor Fill within Protection Zone: Where existing grade is 6inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.9 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.10 TREE & PLANT REMOVAL & REPLACEMENT

A. Field Verification: Before removing non-designated trees, shrubs, stumps, bushes, vines, rubbish, undergrowth and deadwood as shown on the Drawings and as specified, obtain verification from Owner's Representative.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by the Landscape Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by the Landscape Architect.

C. Backfill and compact areas excavated and open pits and holes resulting from removal operations. Comply with requirements herein and as specified in Earthwork, Section 02300 for backfill materials, compaction and installation methods.

D. Remove all stumps and roots in their entirety. Tree trunks shall be removed minimum depth of 2 1/2 feet below existing grade or finish grade, whichever is deeper. Stump grinding is an acceptable method of removal of roots and stumps of trees and shrubs; however, the chip contaminated soil shall be replaced with approved clean planting soil in planting areas and with approved clean fill soil in all other areas.

E. Backfill and compact voids excavated and open pits and holes resulting from removal operations. Comply with Earthwork Specification for backfill materials, compaction and installation methods. Unless required otherwise, in planting areas backfill holes with clean approved planting soil compacted to 90% relative compaction to a minus 12 inches below finish grade and 85% relative compaction for the top 12 inches, except as required elsewhere to a greater degree by Civil or Structural Engineer. In non-planting areas backfill holes with approved fill soil compacted to 95% relative compaction.

F. Remove and replace trees indicated to remain that are more than 25% dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

G. Plant Replacement: Contractor shall replace trees cut or severely damaged due to the Contractor’s work as follows:
1. An ISA Certified Arborist may be retained by the Owner to determine the condition of trees in question as to their ability to survive in a healthy condition and in their original shape, or a pruned aesthetically pleasing shape acceptable to the Owner. Comply with recommendations to rehabilitate as recommended by the Arborist, or to replace in accordance with the requirements below.
2. Trees size shall be determined by Diameter at Brest Height (DBH). Replacement of trees and shrubs shall also include providing acceptable plant installation, automatic irrigation system and a minimum maintenance period of 120 days. If plant(s) is not acceptably maintained and is not healthy and thriving at the end of the 120-day maintenance period, the Contractor shall continue the maintenance work until such time that healthy tree(s) and/or shrub(s) is achieved.
3. Replace any damaged planting in kind using "specimen" plants as follows and at no cost to Owner:
   a. Trees up to 3” DBH: Replace with 36" box size.
   b. Trees 3” to 6” DBH: Replace with 72" box size.
   c. Trees 6” to 12” DBH: Replace with 84" box size.

d. Trees 12” DBH and larger: Tree value shall be determined by Arborist using Council of Tree and Landscape Appraisers (CTLA) method. Replace damaged tree with largest available nursery boxed tree and cash difference between value of damaged tree and nursery stock replacement cost.
e. Shrubs: Replace with 15-gallon can size.

4. Plant and maintain new trees as specified

H. Retain "Excess Mulch" Paragraph below if using a thick mulch layer over tree roots to distribute traffic loads; revise to suit Project.

I. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 3-inch uniform thickness to remain.

J. Retain "Soil Aeration" Paragraph below if aeration, sometimes called "vertical mulching," is acceptable. Professional arborists are divided about benefits of aeration procedures. Aeration opens pathways for air and moisture to reach feeder roots choked by compacted soils. Revise hole diameter or frequency if required.

K. Soil Aeration: Where directed by arborist, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches (300 mm) deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.11 CLEANUP AND DISPOSAL

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

B. Clean excess soil may be distributed on site as accepted by Owner's Representative, if it does not adversely affect specified finish grades or percolation of water into planting soil.

C. Upon completion of work under this Section, remove all tools, equipment and temporary protections, enclosures and structures.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Description of suitable materials for on-site earthwork operations.

2. Definitions of terms.

3. Description of the duties and responsibilities of the Soils Engineer.

4. Requirements for dust, erosion control, and hydroseeding of disturbed areas not designated as planting areas.

5. Requirements for excavation, over excavation, import of select fill, placement of fill, and disposal of surplus material off the project site.

6. Dewatering of excavations.

7. Provision, spreading, and compaction of permeable material.

B. Related Sections include the following:

1. Site Preparation - Section 31 10 00

2. Trenching, Backfilling and Compaction - Section 31 23 16

1.3 REFERENCES

A. Reference Data:

1. If the year of the adoption or latest revision is omitted from the designation, it shall mean the specification, manual or test designation in effect the date the Notice to Proceed with the Work is given.

2. Geotechnical Engineering Investigation, prepared by Signet Testing Labs, entitled “Proposed building 3100 renovation, Napa Valley College”, project number 2407-35, dated November 19, 2021.

1.4 EXISTING CONDITIONS

A. All grading activities shall be in accordance with the Appendix J of the California Building Code, latest Edition and the Geotechnical Engineering Investigation prepared by Signet Testing Labs.

B. At the time of our explorations the site consisted of an approximate 10,000 square foot, single story building; an asphalt concrete parking lot; concrete flatwork; and landscaping. The site was surrounded by open space to the north; a parking lot to the east; open space, an office building and a parking lot to the south; and open space and a creek to the west. The subsurface soils were overlain by asphalt concrete. Beneath the asphalt concrete the near surface soils consisted of sand, silty sand, and sandy silt to a depth of approximately 10 feet below ground surface. Thin layers of clay were present at various depths in CPT-Laboratory testing of bulk samples of the near surface soils indicated the upper 3 feet of soils consisted of clayey sand. The near surface sand was underlain by clay that extended to depths of approximately 12 to 13.5 feet. The clay was underlain by varying layers of sand, silt and clay with generally increasing strength of the soil.

C. California Department of Water Resources well data within about a mile of the site was reviewed for historical groundwater levels. Groundwater varied between depths of about 6 and 15 feet. It should be noted that soil moisture conditions within the site will vary depending on rainfall, adjacent Napa River levels, and/or runoff conditions not apparent at the time of our field investigation. It is common that the soil moisture conditions will change seasonally.

D. It is the Contractor's responsibility to achieve the finished grades shown on the plan, and to determine the quantity of and provide for soil import or export required to achieve plan grades.

1.5 SUBMITTALS

A. Submit test reports and compaction curve analysis for select import fill required in accordance with Section 01 33 00.

1.6 DEFINITIONS

A. Standard Specifications -- Where referred to in these specifications, "Standard Specifications" shall mean the State of California Standard Specifications; and City of Napa Standard Plans and Specifications current editions. All work shall be carried out in conformance with the Standard Specification unless otherwise specified herein.

B. Percent Compaction -- As referred to in these specifications, percent compaction is the required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material determined by the ASTM D 1557 test procedure.

C. Optimum Moisture Content -- As referred to in these specifications, optimum moisture content is the moisture content, percent (by dry weight), corresponding to the maximum dry density of the same material as determined by the ASTM D 1557 test procedure.

D. Percent Relative Density

1. As referred to in these specifications, percent relative density is the required in-place dry density of the material, expressed as a percentage of the difference between minimum dry density and maximum dry density of the same material determined in accordance with the ASTM test method D2049.

E. Soil Subgrade

1. Where used in the specifications soil sub-grade shall mean within exterior slab and pavement areas, the surface on which aggregate base is placed, and within synthetic turf areas, the surface on which the turf system structural/bottom rock is placed.

PART 2 - PRODUCTS

2.1 FILL MATERIAL

A. Fill material shall have an organic content of less than three (3) percent by volume, a plasticity index no greater than 20 percent, a liquid limit no greater than 40 percent and shall not contain environmental contaminants or rocks or lumps larger than six (6) inches in greatest dimension. Onsite materials can be reused as fill if they meet or can be processed to meet the above requirements.

B. Proposed fill materials will need to be approved by the project geotechnical engineer prior to their use. Imported fill materials will need to be approved by the project geotechnical

engineer to their importation to the site. The college may also require that certain fill materials be pre-approved by the project Environmental Consultant.

C. It shall be the Contractor's responsibility to demonstrate to the project geotechnical engineer that the proposed imported material will meet the select fill requirements.

2.2 SELECT FILL

A. Select fill should be free of organic matter, have a low expansion potential, and conform to the following requirements.

B. Plasticity Index of 15 percent maximum.

C. The grading shall conform to the following:

Sieve	Percentage Passing	
	Minimum	Maximum
3”	100	--
1”	100	--
No. 200	5	30

D. All imported fill materials to be used for engineered fill should be sampled and tested by the project geotechnical engineer prior to being transported to the site.

E. Engineered fill should be uniformly moisture conditioned to between 3 and 5 percentage points above the optimum moisture content, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to at least 90 percent relative compaction. Additional fill lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable. Disking and/or blending may be required to uniformly moisture-condition soils used for engineered fill.

F. All trench backfill should be placed and compacted in accordance with recommendations provided above for engineered fill.

G. If import fill is used for pipe or trench zone backfill, the material should consist of fine-grained sand. Coarse-grained sand and/or gravel should be avoided, unless approved by the a The

project geotechnical engineer, due to the potential for soil migration into the materials relatively large void spaces and the potential for water seepage and piping along trenches.

2.3 WOVEN GEOTEXTILE

A. Woven geotextile fabric shall be Mirafi 600x or approved equal.

PART 3 - EXECUTION

3.1 SOILS ENGINEER

A. The work covered by these specifications shall be performed under the observation of the Soils Engineer, who shall be retained and paid by the College. The Soils Engineer will be present at the site intermittently during the conduct of work to observe the work, and to perform field and laboratory tests to evaluate material quality and compaction. The Contractor shall cooperate with the Soils Engineer in performing the observations and tests. The Soils Engineer shall notify the Contractor of failing test results. The Contractor shall rework these areas until the specified degree of compaction is obtained. At the completion of his work, the Soils Engineer shall submit a report to the College, including a tabulation of all tests performed. The Soils Engineer's costs for observing and testing the repair of unsatisfactory work performed by the Contractor shall be billed to the College. The College shall pay them and then shall deduct the amount from monies due to the Contractor.

3.2 SPILLAGE, DUST AND EROSION CONTROL

A. Spillage

1. The Contractor shall prevent spillage when hauling on or adjacent to any public street or highway. In the event that such occurs, the Contractor shall remove all spillage and sweep, wash or otherwise clean such streets or highways as required by local City and County authorities and/or the State of California.

B. Dust and Erosion Control

1. The Contractor shall take all precautions needed to prevent a dust nuisance to adjacent public or private properties and to prevent erosion and transportation of soil to downstream, adjacent properties, due to his work under this contract. Any damage so caused shall be corrected or repaired by the Contractor at no cost to the Owner.

2. All disturbed earth areas not designated for landscape planting shall be hydro-seeded prior to October 15. Hydro-seed mix shall be as specified on the erosion control plans and notes.

C. Owner's Prerogative

1. In the event the Contractor fails to take such precautions or make such corrections or repairs promptly, the Owner may take such steps as he may deem necessary and deduct the cost of same from the monies due the Contractor. Any such action or lack of action on the part of the Owner in no way alters or relieves the Contractor form the proper protection of the work.

3.3 QUANTITIES

A. The Contractor shall perform all necessary calculations and otherwise satisfy themselves as to the quantities involved in the earthwork operation for this project and shall include within this bid any costs associated with importing and placing of select fill and/or exporting of excess material.

B. Earthwork quantities will be impacted by contractor selected trench backfill options, and other miscellaneous excess materials. Contractor is advised to account for these in his bid.

3.4 EXCAVATION

A. Subgrade exposed by completed excavations shall be scarified to a depth of eight (8) inches, moisture conditioned near optimum moisture content and recompacted to 95% relative compaction.

B. Final surfaces exposed by the completed excavations (cutting) shall be finished true to line and grade, and present a smooth, firm surface. Depressions shall be filled and compacted, and loose material shall be removed.

C. Temporary construction slopes shall not exceed requirements set forth in Cal-OSHA Industrial Safety Orders, or ratio suggested.

D. All excess excavated material should be disposed of by the contractor or stockpiled on the site by the contractor for later use as landscaping material.

3.5 OVER-EXCAVATION

A. After stripping the entire area under the proposed buildings and the areas 5' beyond the limits of the buildings, the soils under the proposed building pad should be replaced with non-expansive fill to a depth of at least 12" below the lowest design footing bottom elevation and at least 5 feet beyond the outer edges of the footings horizontally. the exposed underlying soils shall be scarified to a minimum depth of 18 inches below finish design subgrade, moistened to near optimum content and recompacted to at least 90% relative compaction. if loose or soft soil is encounter, these should be removed to expose firm soil and backfilled with select fill moistened to near optimum moisture content and re-compacted to at least 90% relative compaction..

3.6 EMBANKMENT

A. Moisture condition exposed soils to near optimum moisture content; then compact to between 90% in pedestrian areas and 95% percent in vehicular areas (asphalt area east of the building) RELATIVE COMPACTION PER ASTM 1557.

B. Selected fill shall be placed on the prepared subgrade in lifts not to exceed six inches in compacted thickness; moisture conditioned to near optimum moisture content, and shall be compacted by appropriate methods to achieve a relative compaction between 90% and 95% per ASTM D1557.

C. Compacted fill slopes and permanent cut slopes in soil and weathered rock should be no steeper than 2:1 (horizontal:vertical). If fill slopes are constructed, the slopes should be “keyed” into firm materials and constructed as described above. Additionally, drainage should be provided to deter the buildup of hydro-static and seepage forces behind and fill.

D. For temporary slopes, the Federal Occupational Safety and health Administration (OSHA) has promulgated rules for Excavations, 29 CFR Part 1926. OSHA dictates allowable slope configurations and minimum shoring requirements based on categorized soil types. In conformance with OSHA’s categorization, the upper soil is “Type B”. The Contractor may elect to use a variety of shoring and temporary slope configurations, but his operations must conform to Federal and State OSHA regulations. The safety of excavations, slopes, construction operations, and personnel are the sole responsibility of the Contractor.

E.

3.7 FIELD QUALITY CONTROL

A. The project geotechnical engineer will observe the excavation, soil removal, moisture conditioning and recompaction operations. After the completion of these operations and before placement of fill, the Contractor shall obtain a project geotechnical engineer approval of the site preparation in each area.

3.8 DEWATERING

A. During excavation activities, groundwater may be encountered. The contractor is responsible for accounting in their bid the necessary equipment required to remove groundwater from excavations to allow for the proper placement of fill per the CBC.

B. A. During excavation activities, groundwater may be encountered. The Contractor is responsible for accounting in their bid the necessary equipment required to remove groundwater from excavations to allow for the proper placement of fill per the recommendations above.

C. All dewatering activities shall comply with local and State water quality standards.

D. Dewatering shall be performed under a Contractor obtained permit from either the Sanitary District (if discharge is to the sewer system) or the Regional Water Quality Control Board (if discharge is to the storm drain system). The Contractor is advised that both of these agencies may require testing of the proposed dewatering discharge for contaminants. It shall be the sole responsibility of the Contractor to apply for and obtain the necessary permits, obtain and pay for any required water quality tests, design shoring and dewatering systems, and pay any fees associated with discharging the water to the sanitary sewer system if that option is selected. Permits must be obtained prior to any discharge occurring.

3.9 PLACEMENT, MOISTURE CONDITIONING AND COMPACTION

A. All fill shall be placed as engineered fill, moisture conditioned and compacted as described in the following table.

Area	Compaction Recommendations

General Engineered Fill	Scarify subgrade 8” deep, moisture condition and re-compact to 90% relative compaction. Place soil In lifts, a maximum of 8 inches loose thickness, mechanically compacted to a minimum of 90 percent relative compaction, near optimum uniform moisture content.
Paved Areas in vehicular areas and within the paved yard on the east side of the building.	Scarify subgrade 12” deep, moisture condition and re-compact to 95% relative compaction. Limits of scarification shall extend 2’ beyond the limits of the foundation. Place soil In lifts, a maximum of 8 inches loose thickness, mechanically compacted to a minimum of 95 percent relative compaction near optimum uniform moisture content. Proof roll exposed subgrade to a firm and unyielding surface under the observation of the project geotechnical engineer prior to the placement of aggregate base. Placement of suitable geotextile for stabilization may be required. Soft spots or areas of pumping may require over excavation and replacement with suitable material.
Exterior Pedestrian Concrete Areas	Scarify subgrade 12” deep, moisture condition and re-compact to 90% relative compaction. Limits of scarification shall extend 2’ beyond the limits of the foundation.. Place soil In lifts, a maximum of 8 inches loose thickness, mechanically compacted to a minimum of 90 percent relative compaction, near optimum uniform moisture content.
Under Buildings and exterior gas storage structure.	Scarify subgrade 12” deep, moisture condition and re-compact to 90% relative compaction. Limits of scarification shall extend 5’ beyond the limits of the foundation. Place soil In lifts, a maximum of 8 inches loose thickness, mechanically compacted to a minimum of 90 percent relative compaction, near optimum uniform moisture content.
*All compaction requirements stated herein refer to dry density and moisture content relationships obtained through the laboratory standard described by ASTM D-1557.	

B. All site preparation and fill placement should be observed by a representative of the project geotechnical engineer.

C. Where field density tests indicate that required compaction and/or moisture content has not been attained, the fill shall be reconditioned as necessary and recompacted to the required density and/or moisture content prior to placing additional material. The Contractor shall be responsible for placing, moisture conditioning and compacting approved material in accordance with these specifications.

D. Sufficient testing and inspection should be performed to assure compliance with the recommended compaction standards. Samples of proposed native or imported fill should be submitted to the project geotechnical engineer material testing laboratory for assessment at least 48 hours prior to placement or importing to the site (whichever is soonest).

3.10 FINISH

A. Fill slopes shall be compacted by slope rolling and trimming or shall be overfilled and trimmed back to planned grade. The completed fill shall be finished true to line and grade. Depressions shall be filled and compacted and all loose material shall be removed.

B. After completion of compaction and finish grading operations, fill slopes, horizontal surfaces disturbed by construction operations, and cut slopes shall be moisture conditioned and "trackwalked" to provide a firm and uniformly roughened surface free of loose material.

C. See also requirements in landscape specifications for slope and landscaped area requirements.

D. It is the Contractor's responsibility to achieve the finished grades shown on the plan, and to determine the quantity of and provide for soil import or export required to achieve plan grades.

3.11 CLEAN UP

A. Remove all debris and stains resulting from the work of this section, including any and all excess material, which shall be removed from the project site.

END OF SECTION

SECTION 31 23 16

TRENCHING, BACKFILLING AND COMPACTION

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. The Section includes the following:

1. Trenching and other excavation needed for the installation of pipe and appurtenances.

2. Provide and install bedding material as specified.

3. Backfill and compact trenches and excavations with suitable material and as specified.

4. Provide and install subbedding material as required.

B. Related Sections include the following:

1. Earthwork – Section 31 20 00

2. Site Drainage – Section 33 40 00

3. Water Utility Distribution Piping – Section 33 11 00

1.3 SUBMITTALS

A. In accordance with Section 01 3300, Submittal Requirements:

1. Sand equivalent and gradation analysis of bedding and backfill materials.

1.4 REFERENCES

A. Standard Specifications

1. Where referred to in these specifications, "Standard Specifications" shall mean the State of California Department of Transportation Standard Specifications. All work shall be carried out in conformance with the Standard Specifications unless otherwise specified herein.

2. Where referred to in these specifications, "City Standards" shall mean the latest edition of the City of Napa Design and Construction Standards. All applicable work shall be carried out in conformance with the referenced standard.

1.5 EXISTING SITE CONDITIONS

A. The Contractor shall acquaint himself with all site conditions. If unshown active utilities are encountered during the work, the Engineer shall be promptly notified for instruction. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor's operations subsequent to their discovery of such unshown utilities.

B. Portions of the excavation can be expected to encounter competent bedrock a few feet below the surface. Site excavations, including utility trenches, may require a ripping tooth, pneumatic hammering, or possible drill and blast. The Contractor shall review the Soils Report and plan their work accordingly.

1.6 QUALITY ASSURANCE

A. Testing Agency: The project Geotechnical Engineer (Inspector) shall verify the adequacy of sub-bedding conditions and monitor bedding, backfilling and compaction.

B. Unsatisfactory Conditions: The Inspector will advise the Contractor immediately if unsatisfactory conditions or test results are observed. The area where compaction is unsatisfactory shall be reworked until the required density has been attained. The Inspector shall have the authority to reject bedding or backfill until corrective measures to measure unsuitable material or rework as needed have taken place. It shall be the sole responsibility of the Contractor to achieve the specified degree of compaction.

C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this Section.

D. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the soils engineer.

1.7 PROTECTION FROM CAVING

A. Construction Safety Orders

1. Nothing in this section shall be deemed to allow the use of a shoring, sloping, or protective system less effective than that required by the Construction Safety Orders. The Contractor shall take all necessary measures to protect the workmen and adjacent areas and structures from the hazards of the trenching or excavation operations. Sheet piling and other sheeting shall be withdrawn in such a manner as to prevent caving at the walls of excavation or damage to piping or other structures. Except as may be hereinafter modified, no sheeting shall be left in the trench and no backfill shall be made against the sheeting before it is removed. Any sheeting extending below the invert of the pipe shall be left in place by cutting off in a manner satisfactory to the Inspector.

B. Liability

1. Nothing in this section shall be construed to impose tort liability on the Architect, or the Design Engineer.

PART 2 - PRODUCTS

2.1 TRENCH STABILIZATION SUBBEDDING

A. Drain rock for trench stabilization subbedding shall be of the nominal sizes designated as 3/4" x 1/4".

2.2 BEDDING MATERIAL

A. Bedding material shall be well graded sand material free from vegetable matter and refuse.

B. The minimum sand equivalent value shall be 30.

C. The grading shall conform to the following and have a minimum sand equivalent of 30:

Sieve	**Percentage Passing**	
	Minimum	**Maximum**
3/4"	90	100
3/8"	65	100
No. 4	30	100
No. 200	0	5

D. Sand may be used at the Contractor's option.

2.3 TRENCH BACKFILL

A. Backfill material shall be as shown on the detail appropriate to the utility being installed.

B. Backfill material may be native excavated material free of vegetable matter, refuse and other unsatisfactory material.

C. The backfill material shall be free of stone and lumps exceeding 4 inches in greatest dimension.

D. Imported granular trench backfill material may be used in lieu of native material at the Contractor's option.

E. The grading shall conform to the following and have a minimum sand equivalent of 30:

Sieve	**Percentage Passing**	
	Minimum	**Maximum**
3"	100	-
3/8"	100	-
No. 4	40	100
No. 30	10	100

2.4 SUBDRAIN BACKFILL

A. Class 2 Permeable material for filling trenches under, around, and over subdrains shall per the requirements for Caltrans Class 2 Permeable Material.

PART 3 - EXECUTION

3.1 EXCAVATION

A. The Contractor shall make all necessary excavations to construct the work shown on the Drawings and in accordance with trench detail appropriate to the utility being installed and the City (Town/County) Standards.

B. The Contractor shall perform all to the depth indicated on the drawings. During excavation, that material suitable for backfilling shall be deposited in an orderly manner a sufficient distance from the banks for the trench to avoid overloading and to prevent slides or cave-ins. All excavated material not required or suitable for backfill shall be removed and properly disposed of offsite.

C. Excavation shall include the removal of all materials or surface obstructions of any nature that would interfere with the execution of the work, and their replacement to equivalent preconstruction condition after installation of utilities.

D. All trench excavation work shall conform to the Division of Industrial Safety Construction Safety Orders, which are currently in use.

3.2 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.

1. Architect/Engineer and/or Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 PREPARATION

A. Call Local Utility Line Information service at not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.4 TRENCH WIDTH AND DEPTH

Sieve	**Percentage Passing**	
Pipe Size	**Max Trench Width**	**Min Trench Width**
≤18”	pipe diameter plus 9”	pipe diameter plus 6”
>18”	pipe diameter plus 12”	pipe diameter plus 9”

A. The maximum allowable width of trench measured at the top of the pipe shall be the outside diameter of the pipe exclusive of bells and collars, plus twenty-four (24) inches, and such maximum width shall be inclusive of all trench sheeting.

B. Whenever the maximum allowable trench width is exceeded for any reason, the Contractor shall, at his expense, embed or cradle the pipe in concrete in a manner satisfactory to the Engineer.

C. The trench shall be excavated to the dimensions and depth shown on the Drawings and in a manner, which will produce a firm foundation for supporting the entire length of each section of pipe. Bell holes shall be provided so that the load is carried on the pipe barrel.

D. For limited sections, it may be necessary for the trench to be deeper to avoid obstacles shown on the Drawings and/or found in the field. The line or grade, or both, may be ordered changed by the City or District Representative to afford clearance. The Contractor shall be entitled to no additional compensation therefore.

3.5 CONTROL OF WATER

A. The Contractor, at his own expense, shall provide sufficient pumping equipment and the operation thereof to remove ground water from the excavation.

B. Water shall be disposed of in such a manner as to cause no injury to public or private property, nor be a menace to the public health. Discharges directly to storm drainage systems, ditches, and creeks shall not be allowed.

C. Dewatering shall be performed under a contractor obtained permit from either the City (Town, County) of Napa (if discharge is to the sewer system) or the Regional Water Quality Control Board (if discharge is to the storm drain system). The Contractor is advised that both of these agencies may require testing of the proposed dewatering discharge for contaminants. It shall be the sole responsibility of the Contractor to apply for and obtain the necessary permits, obtain and pay for any required water quality tests, design shoring and dewatering systems, and pay any fees associated with discharging the water to the sanitary sewer system if that option is selected. Permits must be obtained prior to any discharge occurring.

3.6 UNSUITABLE SUB-BEDDING

A. Where soft, wet, spongy, or unsuitable trench foundation is encountered, sub-bedding material shall be placed under the pipe to facilitate construction. The cost of furnishing and placing sub-bedding material shall be included in the price bid for the job.

3.7 BRACING EXCAVATIONS

A. Excavations shall be so braced and supported that they will be safe, and the ground alongside the excavation will not slide or settle, and all existing improvements of any kind, either on public or private property will be fully protected from damage.

B. If any damage does result to such improvements, the Contractor shall make the necessary repairs or reconstruction at his own expense.

3.8 PIPE BEDDING

A. Bedding material shall be placed immediately after the pipe joints have been completed and inspected.

B. Bedding material shall be placed carefully around and under the pipe in horizontal layers 4 inches thick after compaction.

C. The bedding material shall be brought up uniformly on each side of the pipe.

D. Bedding material shall have the proper moisture content to assure maximum compaction by using hand or pneumatic tampers.

E. Bedding shall be accomplished in a manner which will not disturb the pipe but will secure a relative compaction of 90 percent.

F. Bedding shall be installed up to 12 inches below and over the bottom/top of the pipe.

3.9 TRENCH BACKFILL

A. Backfill material shall be placed after the pipe and bedding have been inspected by the Inspector. Native backfill may be used, at the contractor's option, outside of exterior slab and pavement areas. All other areas shall use Caltrans Class 2 aggregate base in the upper 12 inches of the trench backfill. All trenches shall be backfilled to pavement or exterior slab structural section subgrade, or to finished grade in unpaved areas.

B. Backfill and compaction of utility trenches in and immediately adjacent to building pads, driveways, parking, and other flatwork areas should be such that no settlement will occur.

C. Where trenches closely parallel a footing and the trench bottom is within a 2 horizontal to 1 (one) vertical plane, projected outward and downward from any structural element, grout slurry should be utilized to backfill that portion of the trench below this plane. The use of slurry backfill is not required where a narrow trench crosses a footing at or near a right angle.

D. Granular Backfill (Non-native)

1. The backfill material shall be placed in layers not exceeding 8" in uncompacted thickness.

2. Compaction may be accomplished by adding sufficient water to the material as it is placed in the trench to achieve 90 percent relative compaction.

3. Supplemental compactive effort using vibratory means shall be employed if necessary to obtain specified degree of compaction.

4. Ponding or the use of excessive amounts of water will not be allowed.

5. Vibratory or other compaction equipment shall be used whenever necessary to obtain the required compaction, and must be used within 12 inches of pavement subgrade in paved areas, where compaction is required to be 95% R.C.

E. Native Backfill

1. Native backfill material shall be placed in layers not exceeding 8" in uncompacted thickness.

2. Compaction may be accomplished by adding sufficient water to the material as it is placed in the trench to achieve 90 percent relative compaction.

3. Supplemental compactive effort using vibratory means shall be employed if necessary to obtain specified degree of compaction.

4. Ponding or the use of excessive amounts of water will not be allowed.

5. Vibratory or other compaction equipment shall be used whenever necessary to obtain the required compaction, and must be used within 12 inches of pavement subgrade in paved areas, where compaction is required to be 95% R.C.

3.10 RESURFACING

A. Onsite: Where trenches occur in existing surfaced areas, the existing surfacing shall be sawcut six inches wider than the trench along both sides. Trench patch shall be a minimum of 2.5” or match the existing asphalt thickness.

3.11 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

END OF SECTION

SECTION 32 12 16

ASPHALT CONCRETE PAVING AND BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Provide, spread and compact aggregate base.

2. Provide, spread and compact asphaltic concrete pavement.

3. Adjust to finish grade new and existing manholes, sewer cleanouts, sewer structures, drainage structures, valve boxes, irrigation controllers, etc., included in the limits of work.

4. Clean surface of asphalt prior to crack sealing/filling or application of sealcoat. Provide and place crack filler sealant to existing asphalt areas to be seal coated as indicated on the plans.

5. Provide and place 2 coats or seal coats to new and existing asphalt pavement locations indicated on the plans.

B. Related Documents:

1. Documents affecting work of this section include, but are not limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these specifications. Contractor is responsible for coordinating all work.

C. Related Sections:

1. Section 31 20 00 – Earthwork

2. Section 31 23 17 – Trenching, Backfilling and Compaction

3. Section 32 16 00 – Concrete Curb, Gutter, and Sidewalk/Walkway

1.3 REFERENCES

A. Reference Data:

1. If the year of the adoption or latest revision is omitted from the designation, it shall mean the specification, manual or test designation in effect the date the Notice to Proceed with the Work is given.

B. City of Napa Standard Plans and Specifications, latest edition.

C. Caltrans Standard Specifications, latest edition.

1.4 QUALITY ASSURANCE

A. A testing laboratory retained and paid for by the District shall do testing and inspection of the aggregate base and asphaltic concrete. Any areas receiving failing tests shall be reworked by the Contractor to achieve the minimum specified degree of compaction. It shall be the sole responsibility of the Contractor to achieve satisfactory results.

B. Test Methods: Unless otherwise indicated, tests shall be made in conformance with the following standard methods:

1. Relative compaction shall be determined by Test Method No. California 216 and 231.

2. Design and Construction Standards of the County of Sonoma, latest edition.

3. Caltrans Standards and Specifications, latest edition.

1.5 SUBMITTALS

1. Submit asphalt mix design parameters and certificates of compliance.

2. Submit certificate of compliance for aggregate base and aggregate subbase.

3. Submittals shall conform to the requirements of Section 01 33 00.

4. Submit manufacturer’s data sheet for crack sealant material

5. Submit product data sheets for seal coat material.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE

A. Aggregate for aggregate bases shall be clean and free of vegetable matter and other deleterious substances.

B. Aggregate base shall be of such a nature that it can be compacted readily under watering and rolling to form a firm, stable base.

C. Aggregate base shall be Class 2, and the combined aggregate shall conform to the 3/4-inch maximum grading specified in Section 26-1.02B "Class 2 Aggregate Base" of the current Caltrans Specifications.

D. Recycled Class 2 Aggregate Base may be used for onsite applications so long as it meets the gradation and strength parameters of virgin material.

E. Recycled Aggregate Base may be used under new paving only so long as it complies with the Specifications for new Class 2 Aggregate Base.

2.2 ASPHALT CONCRETE

A. The asphalt concrete for onsite uses shall be Type A, 1/2 inch maximum, medium, and shall conform to the applicable portions of Section 39 of the Caltrans Standard Specifications. For offsite (public) uses, use Type A, ¾" maximum medium.

2.3 SEAL COAT

A. Seal coat material shall be OverKote Asphalt Pavement Coating (color black) as manufactured by Diversified Asphalt Products, Inc., or approved equal.

B. The Accredited Applicator is required to use the proper equipment in the application of the asphalt pavement coating as per the recommendation of the coating supplier.

2.4 SEAL COAT

A. Crack filler material shall be made by OverKote.

B. Cracks less than ½ inch in width: Guard Top Crack Filler or approved equal.

C. Cracks greater than ½ inch in width: #4 sheet mix asphalt.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION FOR BASE MATERIAL

A. Subgrade preparation shall conform to the requirements in Section 31 20 00 – Earthwork, and shall not vary more than 0.05 foot above, or 0.05 foot below the grade established by the plans.

B. Prepared subgrade shall be inspected by the independent testing laboratory retained by the County prior to the placement of any aggregate base.

C. Subgrade soils shall be in a stable, non-pumping condition at the time of Aggregate Base Rock materials are placed and compacted.

D. Subgrade Soils shall not be allowed to become or saturated or overly dried out prior to the placement of finished surfacing.

E. As per Section 31 20 00 – Earthwork.

3.2 SPREADING

A. Aggregate base shall be delivered to the roadbed as uniform mixtures and shall be graded in layers or windrows. Segregation shall be avoided and the base shall be free from pockets of coarse or fine material.

B. The aggregate base, after spreading as above specified, shall be shaped to such thickness that after watering and compacting the completed base will conform to the required grade and cross section, within the tolerances specified in Section 26-1.03E "Compacting" of the Caltrans Specifications.

C. The base shall be spread, watered and compacted in layers not to exceed 6 inches in compacted thickness to achieve the specified thickness.

3.3 COMPACTION AND TOLERANCE

A. The relative compaction of the base shall not be less than 95 percent.

B. The finished surface of the aggregate base shall not vary more than 0.05 foot from the design grades.

C. Aggregate base which fails to meet the specified tolerances shall be reshaped, rewatered and recompacted at the Contractor's expense.

3.4 SUBGRADE PREPARATION FOR ASPHALT CONCRETE

A. All construction beneath the subgrade shall be completed, including pipeline testing, prior to asphalt concrete placement.

B. Subgrade shall not vary more than 0.05 foot above or below design grade.

C. Any soft spots in the subgrade shall be repaired by the Contractor, regardless of cause, prior to paving.

D. Minimum Class 2 aggregate base material under heavily loaded private sidewalks/walkways as shown on the Drawings shall be 4 inches in compacted thickness.

3.5 TACK COAT

A. Apply tack coat of RS-1 or CRS1 Emulsion to vertical surfaces of existing surfacing that will come into contact with asphalt concrete.

3.6 SPREADING AND COMPACTING ASPHALT CONCRETE

A. Shall be in accordance with Section 39 of the Caltrans Standard Specifications.

3.7 SURFACE PREPARATION FOR SEALCOAT

A. The surface to receive Asphalt Sealcoat must be free of all foreign material and dry immediately prior to sealcoat application. Cleaning may be by air blowing, vacuum, mechanical sweeper, washing, or other techniques as approved by the Engineer. If washing the existing surface is used, the surface shall not have any standing water prior to application of the sealcoat. Salt, cleaning agents, fertilizers, hard water deposits and other such chemicals will promote lack of bonding of the sealcoat to the existing surface any may require extraordinary cleaning measures.

B. Perform crack sealing/filling, prior to the application by Contractor of the Sealcoat. Cracks shall be cleaned of dirt and organic matter by pressure washing. After drying, fill cracks with asphalt emulsion. All cracks must be sealed/filled prior to application of the sealcoat. Cracks that contain weed and other live vegetable matter must be treated with a locally approved non-oil based sterilent prior to filling the cracks.

C. Prior to application of sealcoat, deposits of grease or oil shall be cleaned by scraping, burning, and/or or the use of approved detergents in order to promote adhesion of the sealcoat. After cleaning the areas above, the areas shall be sealed with an oilseal. Oilseal shall be a quick drying latex emulsion with suitable admixtures manufactures specifically for the purpose of isolating the Asphalt Sealcoat from any residual oils, petroleum grease, and gasoline stained pavement. The properties of the Oilseal shall be such as to be compatible with the Asphalt Sealcoat.

D. In areas where the foreign oil or grease has penetrated the asphalt concrete such that cleaning as described above is not effective, the affected areas shall be removed to the depth necessary but not less than ¾ inch. The removed asphalt concrete shall be replaced with new asphalt concrete.

E. On excessively weathered surfaces or areas such that cleaning operation leave a film of dust, a tack coat of SS1h shall be applied. The tack coat shall consist of one (1) part SS1h with four (4) parts water or two (2) parts Asphalt Sealcoat with one (1) part water applied at a rate of 0.05 to 0.10 gal/sq. yd. The tack coat must be dry prior to application of the Asphalt Sealcoat. Application of the sealant shall be by distributor spray bar, with hand spraying kept to a minimum. Temperature of the asphalt sealant shall be sufficiently high to permit uniform spray pattern. For asphalt cements the minimum temperature shall be 150°C (300°F). A spray pattern for asphalt emulsion is improved by heating. Temperatures in the 55°C (130°F) to 70°C (160°F) range are desirable. A temperature of 70°C (160°F) shall not be exceeded since higher temperatures may break emulsion.

3.8 SEAL COAT

A. Surface preparation and application of seal coat shall be per the manufacturer's recommendations.

B. The contractor shall apply two coats of seal coat. The contractor shall let the first coat thoroughly dry before applying the second coat as directed by the manufactures application instructions.

C. Application of the Asphalt Sealcoat shall be by mechanical means using rubber faced squeegees, brooms, distributor bar/wand, or combinations of these or other techniques approved by the Manufacturer and by the Engineer.

D. The Asphalt Sealcoat being applied shall be uniform and free flowing, free of lumps and other inconsistencies. Potable water may be added as necessary as per manufacturer's recommendation, for consistency and spreadability but shall not exceed 15% by volume or as directed by Engineer. If, after the addition of the maximum allowable water volume the sealcoat is unsuitable, the materials shall be rejected and removed from the site.

E. The Asphalt Sealcoat shall not be placed on new asphalt concrete until after a 30 day minimum cure period or as directed by the engineer.

F. Asphalt Sealcoat shall consist of two application coats of material. The sealcoat must be thoroughly dry prior to application of the second or subsequent coats.

G. Application of Asphalt Sealcoat in ambient temperatures in excess of 80 degrees Fahrenheit shall require pretreatment of the asphalt concrete surface with a water mist. The water must not be standing but the surface should be damp prior to sealcoat application. This treatment is also recommended for application on porous surfaces where the water within the sealcoat may be absorbed too quickly by the existing pavement surface.

H. Asphalt Sealcoat shall be applied uniformly over the prescribed area in continuous parallel lines in a manner so that no ridges or uncoated areas shall exist. Application rates will vary depending on the exture of the existing asphalt surfaces requiring more sealcoat than smooth surfaces. Follow manufacturer's recommendations. The following application rate is a guideline only. Smooth dense surface, 20-30 gallons/1000 sf.

I. Asphalt Sealcoat shall not be applied when the ambient temperature is less than 55 degrees and the surface temperature is less than 60 degrees F. Sealcoat shall not be applied within 24 hours prior to forecasted rain, freezing temperatures, during rain, or when the surface contains standing water.

J. Minimum coefficient of friction requirements for both paving and markings. Wet Skid Resistance at pavement <6% slope: (when measured by the NBS-Brungraber machine): 0.60. Wet Skid Resistance at slopes >6%: (when measured by the NBS-Brungraber machine): 0.80.

3.9 SEAL COAT CRACK FILLER

A. All cracks shall be cleaned prior to filling per the manufacturer's recommendations.

B. Cracks less than ½" in width shall be filled with crack filler prior to application of seal coat.

C. Cracks greater than ½" in width shall be filled with #4 sheet mix asphalt prior to application of seal coat.

3.10 SEAL COAT AREAS OPENING TO TRAFFIC

A. Traffic shall not be allowed on the Asphalt Sealcoat until the sealcoat is thoroughly cured, which in warm weather conditions is approximately 24 hours. Minor scuffing or power steering marks may occur on a newly applied surface in warm weather.

B. Irrigation water shall be kept off for at least 24 hours prior to and after the application of Asphalt Sealcoat.

C. After surfacing or resurfacing is completed, the Contractor shall construct or reconstruct the structures to grade as shown on the plans.

3.11 STRUCTURE ADJUSTMENT

A. The Contractor shall mark the location of all structures to be adjusted to grade and shall be responsible for their location after paving operations are completed.

B. After surfacing or resurfacing is completed, the Contractor shall construct or reconstruct the structures to grade as shown on the plans.

3.12 FLOW TEST

A. Finished pavement areas shall be flow tested in the presence of the Inspector of record to confirm that positive gradients that facilitate proper and complete surfacing drainage have been achieved in all paved areas.

B. Any areas that fail the flow test, defined as any area where depth of ponding water exceeds 1/8 inch or where the surface of a ponding area exceeds 10 square feet, shall be repaved to achieve positive drainage.

3.13 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

END OF SECTION

SECTION 32 12 23

PAVEMENT MARKINGS AND SIGNS

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. Furnish materials and install painted traffic striping and markings.

2. Furnish materials and install traffic signs and posts.

B. Related Sections include the following:

1. Section 32 12 16 – Asphalt Concrete Paving and Base.

2. Section 32 10 00 – Bases and Paving.

3. Section 32 16 00 – Concrete Curb, Gutter, and Sidewalk/Walkway

1.3 SUBMITTALS

A. In accordance with Section 01 30 00, Submittals.

1. Paint product data.

2. Sign product data.

1.4 REFERENCES

A. California Manual of Uniform Traffic Control Devices (MUTCD), latest edition.

B. California Code of Regulations, Title 24, Part 2 – California Building Code (CBC), latest edition.

C. American with Disabilities Act (ADA), latest edition.

PART 2 - PRODUCTS

2.1 STRIPING PAINT

A. The paint to be used on striping shall be commercial quality paint. Thinner shall not be mixed with paint.

B. White paint shall be used on new stall stripes and cross walks. Blue paint shall be used on all accessible stall markings as required by CBC. Yellow paint shall be used for all cross walks, loading/unloading zones and striping. Red paint shall be used at all “no parking” areas and fire lanes.

C. Paint shall dry "track free" in not less than thirty (30) minutes and not more than ninety (90) minutes.

D. The air compressor used shall have a capacity of sixty (60) cubic feet per minute.

E. The rate of application of paint:

1. Solid single stripes: seventeen (17) to eighteen (18) gallons per mile.

2.2 SIGNS

A. Traffic and regulatory signs shall conform to the requirements of the MUTCD for the type of sign indicated on the plans. Accessible parking signs shall also comply with the applicable sections of the CBC and the ADA.

B. Signs shall be mounted at standard heights on two (2) inch square unistrut posts set in concrete.

2.3 WHEELSTOPS

A. Wheelstops shall be four feet long and a minimum of four (4) inches high, premanufactured concrete wheel stops.

PART 3 - EXECUTION

3.1 STRIPING

A. No striping shall be started until all paving work on the entire job has been completed, and the various finished surfaces are sufficiently cured to prevent undue tracking onto new striping.

B. All stripes for parking spaces shall have a width of four inches. Play area striping shall be the width and color shown on the plans. All widths shall be within 1/4 inch of the specified widths.

C. All lines and other shapes shall be clean and sharp as to dimensions and shall be painted or painted out in the locations shows on the plans. Ragged ends of segments, fogginess along the sides, or objectionable dribbling along the unpainted portions of the stripe shall not be permitted.

D. The finished product shall have an opaque, well painted appearance with no black or other discolorations showing through. Any smears shall be painted out with black paint to the satisfaction of the Owner's Representative.

E. The Contractor shall take all reasonable precautions to protect the paint during drying time and may be required to paint out all objectionable tracking. Appropriate traffic control necessary to insure non-tracking as well as reasonable traffic flows shall be the Contractor’s responsibility.

F. Painted stripes shall receive two coats of paint to achieve the desired coverage.

G. No work shall be done when the pavement is appreciably damp.

3.2 SIGNS

A. Signs shall be installed in the locations shown on the plans and in accordance with the referenced standards for height, setback from the curb, and embedment.

B. Signs for Disabled accessibility shall be installed in accordance with the requirements of the California Building Code.

3.3 WHEELSTOPS

A. Wheelstops shall be installed in the locations shown on the plans and accordance with the manufacturer’s recommendations.

3.4 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

END OF SECTION

SECTION 32 13 12

LANDSCAPE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide Portland cement concrete site work complete, including the following principal items:
   1. Retaining walls, stairs, and seat walls.
   2. Color and Finish of walkways and pavements.
   3. Site furnishing footings

B. Related requirements specified elsewhere include:
   1. Section 31 00 00, EARTHWORK
   2. Section 32 16 00, CONCRETE CURB, GUTTER, AND SIDEWALK/WALKWAY

1.2 QUALITY ASSURANCE

A. Reference and Standards
   1. Soils Reports: Reports of geotechnical investigations by Signet Testing Laboratories, Inc., August 5, 2022.
   2. Perform work in accordance with all applicable laws, codes and regulations required by State of California.
   3. Reference to "Standard Specifications" shall mean the current Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS.
   4. The American Concrete Institute (ACI): "Manual of Concrete Practice," Parts 1, 2 and 3.
   5. The American Concrete Institute (ACI): “Recommended Practice for Concrete Formwork” (ACI 347R)
   6. The American Concrete Institute (ACI): "Hot Weather Concreting", 305R-99
   7. The American Concrete Institute (ACI): Guide for Concrete Slab construction, 302.1R-07
   8. The American Concrete Institute (ACI): "Standard Specification for Cold Weather Concreting, 306.1-90 (R2002)
   9. United States Voluntary Product Standard for Construction & Industrial Plywood (PS 1-95).
   10. American Plywood Association’s “Guide to Plywood Grades” (APA).
   11. West Coast Lumber Inspection Bureau’s “Standard Grading Rules No. 17” (WCLIB)
   12. Concrete Reinforcing Steel Institute (CRSI): “Manual of Standard Practice” and “Recommended Practice for Placing Reinforcing Bars”.
   13. American Welding Society: AWS A5.1 and AWS D1.1 and D1.2.

14. Americans with Disabilities Act (ADA), Federal ADA/State of California Title 24 Standards.
15. California Code of Regulations, Title 24, 2010 Edition, also known as California Building Code (CBC).

B. Stipulations
1. Finish Surface Tolerance: 1/4-inch maximum variation in 10 feet.
2. At no point shall paving surface fail to drain.
3. Finish Concrete Surface Slip Resistance: Shall have a minimum slip resistance coefficient of 0.65 on concrete pavement with less than 5% slope and 0.8 on concrete pavement with more than 5% slope.
4. Walls retaining soil that retain 30 inches or more of soil shall include a subsurface drain behind wall per Section 68 of the Standard Specifications and as accepted by the Owner's Representative. Drain line shall be connected to storm drain system as accepted by Owner's Representative.
5. Walls retaining soil that retain 18 inches or more of soil shall receive Dampproofing per Caltrans Standard Specifications, Section 54.
6. Contractor shall pour adjacent slabs in a way that does not impact finish quality or construction (expansion) joint dimensional stability.

C. Testing and Inspection, per Section 01 40 00.

D. Conform to ACI 306, Section 5.13 during hot weather and cold weather.

E. Requirements of ACI 318 shall govern work, materials and equipment related to this Section; specifications herein set minimum results required, and references to procedures are intended to establish minimal guides.

F. The Contractor shall be responsible for quality of concrete in place and shall bear burden of proof that concrete meets minimum requirements. Contractor shall confirm that site soils do not contain elevated levels of sulfate that would require sulfate resistant concrete as outlined in ACI 306. If the site soils contain elevated levels of sulfate, it is the Contractor's responsibility to request mixes that meet the requirements.

G. Placing of concrete by means of pumping will be an acceptable method of placement providing that the Contractor can demonstrate that:
1. Specified concrete strengths will be met.
2. Equipment has a record of satisfactory performance under similar conditions and using a similar mix.
3. Trial batches have been successfully made.

H. Installer Qualifications: Concrete work shall be by firm with 5 years experience with work of similar scope and quality.

I. Formwork Design Criteria: Formwork shall conform to ACI 347-04 and CBC.
1. Formwork:
   a. Shall prevent leakage or washing out of cement mortar.
   b. Shall resist spread, shifting, and settling.
   c. Shall reproduce accurately required lines, grades and surfaces within tolerances specified.

2. Safety: The Contractor shall be responsible for adequate strength and safety of all formwork including falsework and shoring.
3. Formwork allowable tolerances: Formwork shall produce concrete within tolerance limits recommended in ACI 347-04, unless otherwise noted.

1.3 TESTS

A. The Owner will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary. Costs for such tests will be paid by the Owner. Contractor shall cooperate in arranging tests and shall be responsible for notifying the designated laboratory in sufficient time to allow taking of samples at time of pour.

B. Should tests show that concrete is below specified strength, Contractor shall remove all such concrete, as directed by the Owner. Full cost of removal of low strength concrete, its replacement with concrete of proper specified strength and testing, shall be borne by Contractor.

1.4 COORDINATION

A. Coordinate items of other trades. Contractor shall be responsible for the proper installation of all accessories embedded in the concrete and for the provision of holes, openings, etc., necessary to the execution of the work of the trades.

1.5 SUBMITTALS, per Section 01 30 00.

A. Samples of all materials under this Division shall be supplied for testing as requested by the Owner.

B. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor certifying that each material item complies with or exceeds requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

C. Submit two full-scale mock-up (minimum 4’ by 4’) sample panels of all concrete paving finishes and color, including lampblack and Davis ‘pebble’ colors. The samples shall include curing compound if any is to be used, and include an expansion joint and a score joint, as indicated on the Drawings. Approved samples shall be kept at the job site to serve as a prerequisite for all finishes until acceptance of the Work.

D. Submit full scale mock up of retaining wall and concrete seatwall of all concrete finishes (light sandblast/acid etch and smooth form), colors and with skateboard deterrents embedded as indicated on the Drawings. Approved samples shall be kept at the job site to serve as a prerequisite for all details, finishes and color until acceptance of the Work.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Supply ready mixed concrete throughout. Batch, mix and transport in accordance with ASTM C-94, "Specifications for Ready Mixed Concrete."

B. Mix and deliver concrete in quantities that will permit immediate use only.

C. Indiscriminate addition of water for any reason will be cause for rejection of the load.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Cement and aggregates shall have proven history of successful use with one another. Sources of cement and aggregate shall remain unchanged throughout work.

B. Mixes:
1. Ready-mixed concrete shall meet requirements of ASTM C94.
2. The Contractor shall perform tests or assemble the necessary data indicating conformance with specifications.
3. For each mix, submit data showing that proposed mix will attain the required strength in accordance with requirements of Caltrans Standard Specifications, Section 90.
4. Instruct Laboratory to base mix design on use of materials specified and approved by the Owner's Representative.
5. Mix design shall include compression strength test reports per CBC Section 1905A.6.3.
6. Insure mix designs will produce concrete to strengths specified and of uniform density without segregation.
7. If mix yield exceeds 1-cubic yard, modify mix design to no more than one cubic yard, without changing cement content.
8. Introduction of calcium chloride will not be permitted.
9. Mix design shall be in accordance with CBC Section 1905A.3.

C. Concrete Types (See Drawings for any other miscellaneous items not listed below):

TYPE	28-DAY STRENGTH	AGGREGATE SIZE	FINISH & COLOR	COMMENTS
Pedestrian Paving	S.C.D.	S.C.D.	See Landscape Drawings and Specifications	
Seat Walls & Retaing Walls	3,000	1/2" X 1/4"	See Drawings and Specifications	
Concrete Stairs and Footings	3,000	1" X #4	See Drawings and Specifications	

2.2 FORMWORK MATERIALS

A. For Exposed Smooth Form-finished Concrete: Use Medium Density (or better) Overlaid Concrete Form Exterior (MDO), to provide continuous straight, smooth, exposed surfaces without grain patterns. Furnish in largest practicable sizes to minimize number of joints and to conform to a joint system as approved by Owner's Representative.

B. Chamfer Strips: Meadow-Burke Concrete Accessories, PVC type CSF ½-inch or as otherwise shown, all exposed corners.

C. Form Release Agent: Must not stain or otherwise adversely affect architectural concrete surfaces. "Nox-Crete Form Coating"; Industrial Synthetics Corp.'s "Synthex"; or equal.

D. Form Ties: Burke "Penta-Tie," or equal, cone and rod type with 1-inch break-back.

2.3 REINFORCING MATERIALS

A. New, free of rust, Billet steel bars: Current ASTM designation A615.

B. Bar Reinforcement: ASTM A615.
1. #3 and smaller: Grade 60.
2. #4 and larger: Grade 60.
3. Tie wire: #6 minimum, black and annealed.

C. Bar Reinforcement recycled content shall be a minimum of 75% recycled post-consumer steel.

D. All reinforcing steel, bolts anchors, sleeves, etc. shall be securely anchored in place before concrete is placed. All reinforcing details, fabrication and installation shall conform to ACI Standard 315, latest edition, except as noted. Stagger all splices where practical and not otherwise detailed. Minimum concrete protection for reinforcement shall be as follows unless otherwise noted:
1. 3" clearance where concrete is placed against the earth.
2. 2" clearance where concrete is exposed to earth or weather but placed in forms.

E. Accessories: Metal and plaster spacers, supports, ties, etc. as required for spacing, assembling and supporting reinforcing in place. Legs of accessories to be of type that will rest on forms without embedding into forms. Galvanized metal items where exposed to moisture, or use other approved non-corrodible, non-staining supports.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II, except if water or soil is high in sulfates use Type V Portland Cement as described above under Quality Assurance. Use one brand of cement throughout project.

B. Fly Ash: ASTM C618, Class Type C or Type F. Can use with pozzolan, ground granulated blast furnace slag and silica furme.

C. Aggregates: ASTM C33, materials from established sources with proven history of successful use in producing concrete with minimum shrinkage.

D. Water: Clear and potable, free from deleterious impurities.

E. Admixtures:
1. Admixtures are optional; however, a water reducer or plasticizing admixture shall be included in the concrete mix and it must be compatible with color pigments where color pigments are required. Any proposed admixture shall comply with ASTM C494.
2. Where more than one admixture is proposed, include statement from admixture manufacturer indicating that admixtures proposed for use are compatible, such that desirable effects of each admixture will be realized.
3. Accelerating admixtures and admixtures containing more than 0.05 percent chloride ions are not permitted. If an accelerator is used, it shall be an non-chloride accelerator.
4. Liquid admixtures shall be considered part of the total water.
5. Refer to Color Additives/Pigments herein for color admixtures.
6. Davis # 641 Pebble

2.5 CONCRETE MIXES

A. Concrete mixes shall be approved and shall be in accordance with Caltrans Standard Specifications Section 90. Unless otherwise noted, mix shall contain not less than 590 pounds of cementitious material per cubic yard (Class "2", 3,000 psi,) Type II Portland cement and a maximum aggregate blend of 1" by #4.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast furnace slag, and silica fume as needed to reduce the amount of Portland cement by 15 to 40 percent. Limit by percentage of weight of cementitious materials other than Portland cement in concrete mix.

C. Lampblack for all exposed concrete except integral color concrete.: As supplied by batch plant for plain non-colored concrete work. Concrete for non-colored pavements shall be darkened by the addition of lampblack at the mixer. The proportion of lampblack or other approved colorant shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Owner's Representative. Provide ¾ pound of lampblack per cubic yard of concrete unless required otherwise.

2.6 ANCILLARY MATERIALS

A. Aggregate Base: Crushed aggregate, R-78 minimum, 3/4-inch maximum, conforming to Standard Specification 26.1.02A, Class 2.

B. Expansion Joint Material

1. Caulked Isolation Joint: "Sonolastic Sealant Two-Part" as manufactured by Sonneborn-Contech, Building Products Division, Contech, Inc.; or approved equal. Joint caps or bond breaker tape to be as recommended by sealant manufacturer. Color shall match paving

C. Dampproofing: Per CALTRANS Standard Specifications, Section 54.

D. Subsurface Drain behind Retaining-Type Walls: All concrete walls that retain 30 inches of soil or more shall include a subsurface drainage system to relieve water pressure in accordance with Section 68 of the CALTRANS Standard Specifications and as shown. If no subsurface drain is shown, provide corrugated polyethylene plastic tubing per 68-1.02K surrounded with an envelope of Class 2 permeable material in conformance to Section 68 "Subsurface Drains" of the Standard Specifications, 3/4 inch maximum without fines and wrapped with filter fabric per 68-1.028. Provide black colored rodent-proof slotted cap over exposed outfalls as accepted by Owner's Representative.

E. Curing Materials for non-colored Concrete:
1. Waterproof Paper: ASTM C171, Type 1.1.1.1, regular. Same as Sisalkraft Division of St. Regis Paper Co.'s "Orange Label", or equivalent.
2. Impervious sheeting: 4 mil white polyethylene laminated to 10 oz. Burlap, ASTM C171, Type 1.1.3, fungus-resistant.
3. Curing Compound: ASTM C309. Product: Sealtight 1100 Clear-Series by WR Meadows, Burke Azua Resin Cure by Edocol, or equal that will not discolor concrete or affect bonding of other finishes applied thereafter, and which restricts loss of water to not more than 0.500 grams per sq. centimeter of surface when tested per ASTM C156, "Test Method for Water Retention by Concrete Curing Materials."

F. Curing Compound for Colored Concrete: Water-base acrylic type, free of permanent color, oil or wax, complying with ASTM C309: "W 1000" by Davis Colors, Los Angeles, CA (800) 356-4848; "Cureseal" semi-gloss by L.M. Scofield Co., Los Angeles, CA (800) 800-9900; or equal.

G. Grout: Premixed high strength non-shrink grout requiring only addition of water at the site. Burke's "Non-Ferrous, Non-Shrink Grout"; Master Builders "Masterflow 928 Grout", or equal.

H. Patching Mortar: Mix in proportions by volume of one part cement to two parts fine sand.

I. Stairs Paint Striping: Provide paint stripes using two-part water-base, Black color epoxy paint with non-skid abrasive grains additives with minimum 5-year warranty, by National, Benjamin Moore, or equal. Apply in accordance with manufacturer's specifications.

2.7 PAINT FOR STAIR NOSINGS

A. Provide paint stripes in accordance with ADA/Title 24 requirements using two-part waster base, (Black) color epoxy paint with non-skid additives with minimum

5-year warranty by National, Benjamin Moore, or equal. Apply in accordance with Manufacturer's specifications.

2.8 FILTER FABRIC / PERMEABLE LANDSCAPE FABRIC

A. Polyester or polypropylene non-woven filter fabric with uniform fiber distribution by "Terra Bond" #1115, "Mirafi, Inc." #140N, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all concrete work true to line and grade as indicated on the Drawings.

B. Correct irregularities to the satisfaction of the Owner's Representative.

C. Plain non-colored, exposed concrete shall contain lampblack, approximately 3/4 pound of lampblack per cubic yard, as accepted by Owner's Representative.

D. The intent of the Grading Drawings is to provide positive drainage and to maintain slopes on walkways as required by the Americans with Disabilities act and California Title 24 throughout the project site. Notify the Owner's Representative immediately of any discrepancies between the Drawings and actual field conditions and/or conflicts between the design and Code requirements.

3.2 PREPARATION

A. Examine subgrades and installation conditions. Do not start concrete work until unsatisfactory conditions are corrected.

B. Provide subgrade preparation and the base material installation complete, including clearing, grading, excavation, filling and dewatering. Take every precaution to obtain a subgrade of uniform bearing power compacted to a minimum of 95% relative compaction as determined by the ASTM D1557 laboratory test procedure and in Sections 19 and 20 of the Caltrans Standard Specifications.

C. Subgrade shall be kept moist and shall not be allowed to dry out before placement of concrete. Place no material on muddy subgrade. Remove un-compactable material and replace with clean fill and compact as required.

D. Aggregate base, where indicated, shall be placed and compacted in conformance with Caltrans Standard Specifications 26-1.04 and 26-1.05.

E. Obtain approval of subgrade from Owner's Representative prior to placing steel and concrete.

3.3 FORMS

A. Forms shall be constructed in accordance with ACI 318, Section 6.1 and shall be of sufficient strength and sufficiently tight to prevent visible distortion or leakage of mortar and fines.

B. Forms for exposed surfaces shall be constructed to protect intended finish. Deflection of facing material between studs shall not exceed 0.0025 of the span. Facing material and pattern of joints shall be as approved by the Owner's Representative.

C. For vertical surface of wall footings below grade, clean cut trench may be used in lieu of form if character of soil will permit installation without sluffing and width of concrete is increased at least 1 inch beyond indicated dimension of each face poured against earth.

D. Curb and pavement edge forms shall extend full depth of concrete and shall be coordinated with installation of planting root barriers where required. Curves shall be formed with flexible metal or wood made up of thin laminations. Curve forms shall extend one stake space straight beyond tangent point. Where curbs and pavement are adjacent to areas to receive root barriers, provide smooth uniform edges. Remove any excess concrete as required to allow installation of root barriers without gaps between curbs and/or pavement and barriers.

E. Maintain forms within the following tolerances.

1. Top of Form: Plus or minus 1/8 inch in 10 feet and no abrupt variations; at required elevation to plus 3/8 inch.
2. Face of Form: Plus or minus 1/4 inch in 10 feet longitudinal and no abrupt variations; perpendicular to surface plus or minus 1/8 inch.

F. Form Ties: Align form ties as accepted by Owner's Representative. Obtain approval of form work from Owner's Representative prior to placing concrete.

G. Forms may be reused upon cleaning and coating with parting compound to ensure separation from concrete without damage.

H. After concrete is placed, the following minimum times shall elapse before removal of forms.
1. Walls and benches: 48 hours.
2. Footing sides: 24 hours.

3.4 REINFORCEMENT

A. All concrete footings, walls, grade-beams shall be steel reinforced unless specifically noted to be "not reinforced." If no reinforcement is shown, reinforce in same manner as that shown in similar places or as accepted by Owner's Representative.

B. Fabricate and place reinforcement as indicated on the Drawings and in accordance with ACI "Detailing Manual" SP-66. No reinforcement shall be placed prior to distribution of the approved shop drawings.

C. Secure reinforcement in position by suitable supports and by wiring at intersections with tie wire. Supports shall be of sufficient number and strength to resist crushing or displacement under full load. Metal shall not extend to surface of concrete.

D. At time of placing concrete, reinforcing shall be free of excessive rust, mill scale, or other bond reducing matter. Immediately before placing concrete, check and adjust position, support and anchorage.

3.5 CLEANING, PATCHING AND DEFECTIVE WORK

A. Where concrete is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcement, signs of freezing, mismatched color, or is otherwise defective, and, in the Owner's Representative's judgment, these defects impair proper strength or appearance of the work, the Owner's Representative will require its removal and replacement at the Contractor's expense.

B. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycombed areas, etc., with patching mortar colored and textured to match concrete. Remove ledges and bulges.

C. Compact mortar into place and neatly file defective surfaces to produce level, true planes. After initial set, dress surfaces of patches mechanically or manually to obtain same texture as surrounding surfaces.

D. Rock Pockets:
   1. Cut out to full solid surface and form key.
   2. Thoroughly wet before casting mortar.
   3. Where the Owner's Representative deems rock pocket too large for satisfactory mortar patching as described, cut out defective section to solid surface, and replace.

E. Cleaning
   1. Insure removal of bituminous materials, form release agents, bond breakers, curing compounds, if permitted and other materials employed in work of concreting that would otherwise prevent proper application of sealants, liquid waterproofing, and other delayed finishes and treatments.
   2. Where cleaning is required, take care not to damage surrounding surfaces or leave residue from cleaning agents.

3.6 MIXING AND PLACING CONCRETE

A. Conform to applicable requirements set forth in Caltrans Standard Specifications Section 51-1.09 and Section 90.

B. Mixes for integrally colored concrete shall have pigment added early enough to ensure complete dispersal and uniform color, but not less than 15 minutes before placing.

3.7 JOINTS AND GROOVES IN FLAT WORK

A. See Section 32 16 00 for sidewalks/walkways.

B. Plane of joints shall be perpendicular to surface. Where new pavements join existing, joints shall align.

C. Sawn Contraction Joints:
1. General: Provide where shown. Saw cut straight, true, and uniform,1/8 inch-wide and not less than 1/4 of slab thickness in depth , unless otherwise noted. Cut with a power saw fitted with an abrasive or diamond blade.
2. Commence saw cutting operations after concrete has cured long enough to resist damage by the saw cutting operations and early enough to avoid random contraction cracks.
3. Contractor shall coordinate form removal and sequencing of adjacent concrete placement to minimize unnecessary saw cutting of adjacent surfaces.
4. Contractor shall plan for the use of varying types of saw cutting apparatus to provide acceptable finishes in areas limited in accessibility.
5. Fill saw cut over-runs and inadvertent saw cutting of adjacent surfaces with cement mortar to match color and finish of sawn pavement.
6. If the joint pattern is not shown, provide joints not exceeding 6 feet in either direction and located to conform to column centerlines, wall corners, etc. as accepted by Owner’s Representative.

D. Expansion Joints in Flat Work: Provided at the location and intervals as shown on the drawings, and at all locations where concrete paving abuts buildings, curbs, walls, columns, or other structures, and not more than 16 feet on center. Specified and shown joint material shall be placed with top edge 1/8" below the paved surface and shall be securely held in place to prevent movement. Joint and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression. All edges shall be struck before and after brooming.

E. Sealed Joints: After the curing period, expansion joints shall be carefully cleaned and filled with approved joint sealant to just below adjacent paved surface in such a manner as to avoid spilling on paved surfaces or overflowing from joint.

3.8 JOINTS AND GROOVES IN WALLS

A. Provide control joints (weakened plane) in walls as show on Drawings, and not to exceed 16 feet on center. Provide "V"-type control joint both sides of wall opposite one another and connected across the top unless shown otherwise. If

V joint is omitted on top of wall, add bridging rebars to reduce cracking as accepted by Owner's Representative.

3.9 FINISH OF CONCRETE TREADS AND STEP STRIPING

A. Finish: Medium broomed lengthwise for a non-slip finish.

B. Step Striping: Prepare surfaces per manufacturer's recommendations (At a minimum, remove dirt, grease loose mortar, scale, salts, alkalies, and other detrimental substances with solution of trisodium phosphate, acid etch, and rinse with clear water and allow substrate to dry).Paint the area with contrasting colored masonry paint, black color unless required otherwise. Paint stripe shall be neat and uniform and shall be at least as slip resistant as the pavement surface.

3.10 FINISHING

A. Sidewalks/Walkways and Stairs
   1. Surface Finishes
      a. Medium Broom Finish: Obtain by drawing a stiff bristled broom across a floated finish for a nonslip surface. Perform brooming while concrete is still wet enough to receive broom marks to match approved sample. Direction of brooming to be perpendicular to direction of work or as otherwise shown on the drawings.

B. Seatwalls and Retaining Walls
   1. Horizontal and vertical finishes
      a. Light Sandblast / Acid Etch Finish Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish. Top of walls finish to match vertical wall finish.

3.11 DAMPPROOFING

A. Mop apply one heavy coat of asphalt dampproofing to soil side of retaining walls and planter walls from top of wall footing to a minus 2 inches below finished soil grade.

3.12 CURING

A. Cure non-colored exposed concrete in accordance with Caltrans Standard Specifications Section 90-7.

B. Cure colored exposed concrete using Curing Compound for Colored Concrete as specified herein.

C. When applying Curing Compound, apply after initial set of fresh concrete when bleed water has evaporated from surface using a "Hudson-type" airless sprayer in accordance with manufacturer's specifications.

D. Only water or curing compounds which impart no permanent color or gloss shall be used for curing concrete.

END OF SECTION

SECTION 32 14 12

CONCRETE UNIT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all labor, materials, equipment and services required for and incidental to the installation of concrete pavers.

B. Related Work included elsewhere
:

1. Section 31 00 00, EARTHWORK
2. Section 32 13 12, LANDSCAPE CONCRETE

1.2 QUALITY ASSURANCE

A. A person who is thoroughly familiar with the type of materials being installed and the methods for their installation shall be present at all times during execution of the work.

B. Testing and Inspection, per Section 01 40 00.

1.3 SUBMITTALS, per Section 01 30 00

A. In addition to manufacturer's standard product data for each manufactured product, submit the following:
1. Copies of product cut-sheet and product literature.
2. Paver chip samples (3 ½ minimum) indicating full range of color and texture to be expected in completed work.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate functional and aesthetic effects and set quality standards for materials and execution. Construct an 6'-0" x 6'-0" minimum sample area at job site with 2x4s restraints and vibrate in place including all color patterns, bands and paver field with edges cut to match the restraints. Protect sample panel until unit paving work is accepted. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 CODE REQUIREMENTS:

A. Conform to the requirements of all applicable local, state and federal building and safety codes, ordinances and regulations.

B. The dynamic coefficient of friction (DCOF) required to meet code.

1.5 PRODUCT HANDLING:

A. Deliver and unload concrete and stone pavers at job site on pallets and bound in such a manner that no damage occurs to the product during hauling, handling or unloading at the job site. Provide bedding and joint sand in such a manner as to deter contamination including saturation of water..

1.6 WARRANTY:

A. Warrant all of the work under this Section to be free of defects of any kind, whether due to workmanship or materials, for a minimum period of one year from the time of completion of the project. This one year warranty does not negate the various manufacturers warranties that are longer than one year.

PART 2 - PRODUCTS

2.1 CONCRETE PAVERS

A. Concrete pavers shall be in accordance with the drawings, patterns, and details as shown on the plans and/or contained within these specifications. All concrete and stone pavers shall be produced by single source manufacturers. Concrete pavers shall be sealed as recommended by manufacturer.
1. Concrete Pavers: Concrete pavers shall be made from 5000 psi (34,450 kPa) hardrock concrete using Type III cement.
2. Materials used to manufacture concrete pavers shall conform to the following:
a. Cement: ASTM C150 (Portland Cement)
b. Aggregates: ASTM C33 (washed, graded sand and rock; no expanded shale or lightweight aggregates).
3. Paver: 24” X 24” X 2.5”, Large Scale CalArc Paver,finish and color:1806 Almond, manufactured by Stepstone Inc. Gardena, CA (800) 572-9029;.

2.2 SAND LAYING COURSE:

A. Sand laying course shall conform to ASTM C33 as follows:

Sieve Size	3/8 in.	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100
% passing	100	95-100	80-100	50-85	25-60	10-30	2-10

B. CALTRANS Department of Transportation Specifications 90-3.03, Fine Aggregate Gradings:
1. Thickness of sand laying course nominal 1" and uniform to ensure an even surface.
2. The sand laying course shall be the responsibility of the paver installer.

2.3 SAND JOINT FILLER: Washed, sharp, angular, silt-free Plaster Sand.

2.4 SEALER:

A. Joint stabilizing Sealer, water-based, single component, epoxy-modified, penetrating sealer and joint sand stabilizer. Shall be VOC, EPA, OSHA and FDA compliant through 2007 as recommended by concrete paver manufacturer.

2.5 AGGREGATE BASE (Base Rock)

A. Crushed aggregate, R-78 minimum, 3/4-inch maximum, conforming to Standard Specification 26.1.02A, Class 2.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Provide subgrade preparation and the base material installation complete, including clearing, grading, excavation, and filling and dewatering. Take every precaution to obtain a subgrade of uniform bearing power compacted to a minimum of 90% relative compaction as determined by the ASTM D1557 laboratory test procedure and in Sections 19, 25 and 26 of the Caltrans Standard Specifications.

3.2 AGGREGATE BASE

A. Deliver to site as a uniform mixture and spread each layer in one operation without segregation.

B. Class 2 Aggregate Base, ¾" maximum size, shall be readily spread and compacted with equipment that will provide a uniform layer conforming to the planned section, to a relative compaction of not less than 95 percent as specified in Section 26 of the Standard Specifications. Confirm that the aggregate base is as specified and to the required subgrade before beginning work.

3.3 SAND LAYING COURSE:

A. Install dry sand to uniform depth required for flush finish after pavers are installed. The designed nominal depth shall be one inch thick with no sand thickness less than ¾" or more than 1 ½". Sand is to remain undisturbed prior to the installation of pavers. Moisture content of sand to remain constant.

3.4 PAVER INSTALLATION

A. Before installing, clean concrete and stone pavers of all foreign material. Do not begin installation of pavers until subgrade and base have been prepared per Specifications.

B. Screed sand bedding course to recommended depth. Sand is to remain undisturbed prior to the installation of unit pavers. Maintain constant sand moisture content.

C. Where pavers occur over concrete sub-slab, set with ¾ inch thick mortar bed.

D. Start installation from a corner or straight edge, unless detailed otherwise, and proceed forward over the undisturbed sand bedding course with pavers as shown on Drawings. Cut pavers with a masonry saw, clean and uniform to conform to edges without gaps. Cut pavers to avoid thin slices.

E. Install pavers plumb and true to line and grade to coincide and align with adjacent work and elevations in accordance with Drawings. Use string lines to hold pattern lines true. Maximum vertical deflection shall not exceed 3/8 inch under a 10 foot straightedge. All perimeter edges must be retained to secure the pavers and sand bedding course. Provide retainer as required. No paver joint shall be greater than 1/4" inch. No perimeter edge joint shall be greater than 3/8".

F. Cut pavers with a double bladed stone cutter or diamond blade masonry saw.

G. Spread plaster sand over the installed and approved pavers and sweep the sand into the paver joints. Insure all joints are full before clean up. Swept up and remove excess sand from the completed paver installation.

H. The completed paving installation shall be swept and washed down to provide a clean, finished, workmanlike hardscape pavement.

I. The final surface elevation of pavers shall not deviate more than 3/8 in. under a 10 ft long straightedge and 1/8 in. between individual pavers.

J. The surface elevation of pavers shall be 1/8 to1/4 inch above adjacent drainage inlets, concrete collars or channels.

K. Apply Water-based Paver Sealer after final cleanup and wash down of paving surfaces. Prior to applying Water-based Sealer, remove any stains and efflorescence using cleaners as recommended by manufacturer. During application, protect surrounding areas from over spray. All traffic, pedestrian or vehicular, shall be kept off of sealed pavers until initial cure time has been achieved.

3.5 CLEANUP

A. Perform the work under this Section so as to keep affected portions of the buildings and site neat, clean and orderly. Upon completion of the work under this Section, remove immediately all surplus materials, rubbish and equipment associated with or used in the performance of this work.

B. Reset all disturbed pavers and brush joints with sand. Reseal individual pavers as required.

END OF SECTION

SECTION 32 16 00

CONCRETE CURB, GUTTER AND SIDEWALK/WALKWAY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Place concrete curbs, gutters, valley gutters, and sidewalks/walkways.

B. Provide mock-up of exterior concrete walk finish, including, but not limited to, texture, color, and score pattern.

1.2 RELATED DOCUMENTS

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

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

1. Concrete Reinforcing – Section 03 20 00

2. Cast-in-Place Concrete – Section 03 30 00

3. Earthwork – Section 31 20 00

4. Asphalt Concrete Paving and Base – Section 32 12 16

1.3 REFERENCES

A. Reference Data:

1. If the year of the adoption or latest revision is omitted from the designation, it shall mean the specification, manual or test designation in effect the date the Notice to Proceed with the Work is given.

B. City of Napa Standard Plans and Specifications.

C. Caltrans Standard Specifications, Sections 73 (Concrete Curbs and Sidewalks) and 90 (Concrete).

1.4 SUBMITTALS

A. Submit concrete mix design to Engineer for review at least 21 days prior to concrete.

B. Submit mock-up of exterior concrete walk finish, including, but not limited to, texture, color, and score pattern to Architect for review prior to any concrete installation.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Concrete shall comply with the applicable provisions of Section 90 " Concrete" of the Caltrans Standard Specifications for Section 90-2 ”Minor Concrete” and meet the following requirements listed below.

1. Concrete shall have a minimum 28 day compressive strength of 3,000 psi.

2. Concrete shall have a maximum slump of 4 inches.

3. Concrete must contain at least 505 pounds of cementitous material per cubic yard.

4. Cementitious material must be Type II or V Portland cement or a combination of Type II or V Portland cement and other approved Supplementary Cementitious Materials (SCM’s). Typical SCM’s are ground granulated blast furnace slag, fly ash, silica flume, rice hull ash and natural pozzolans such as calcined shale, calcined clay and metakaolin. The amount of SCM’s in the concrete mix shall not exceed the requirements listed in section 90-1.02B of the Caltrans Standard Specifications.

5. The quantity of free water must not exceed 310 pounds per cubic yard of concrete plus 20 pounds of free water for each required 100 pounds of cementitious material in excess of 550 pounds of cementitious material per cubic yard of concrete.

6. The maximum course aggregate size must not be larger than 1-1/2” or smaller than ¾” and meet the gradation requirements in section 90-1.02C(4)(b).

7. Fine Aggregate grading shall meet the gradation requirements in section 90-1.02C(4)(c).

8. Acceptable admixtures shall conform to Section 90-1.02E. Chemical admixtures must comply with ASTM C 494, Air-entraining admixtures must comply with ASTM C 260.

9. For textured and colored concrete surfaces, aggregate must comply with the grading requirements for fine aggregate in section 90-1.02C(4)(c). Aggregate used in grout for textured and colored concrete surfaces must comply with the grading requirements listed in section 73-4.02. Color pigments for dry-shake method must comply with ASTM C 979.

B. Concrete for sidewalk/walkway, valley gutters, curbs and gutter for improvements in public right of way shall conform to City of Napa requirements.

PART 3 - EXECUTION

3.1 GENERAL

A. Curbs, gutter, valley gutters, and sidewalks/walkways shall conform to the details shown on the plans and any applicable City of Napa Standards for those improvements constructed within the public right of way.

B. Provide representative mock up of sidewalk including, but not limited to, texture, color, and score pattern for review and approval by Architect prior to construction.

C. Concrete finishes along accessible routes of travel shall be at least as slip-resistant as that described as a medium salted finish for slopes of less than 6%, and slip-resistant at slopes of 6% or greater.

D. Concrete finishes within the public right of way shall conform to the City of Napa standards and specifications.

E. Concrete finishes in non accessible path of travel areas should be a medium broom finish.

3.2 SUBGRADE PREPARATION

A. As per Section 31 20 00, Earthwork.

B. Minimum Class 2 aggregate base material under sidewalks/walkways as shown on the Drawings shall be at least 4 inches in compacted thickness, or otherwise noted.

C. Material under public sidewalks/walkways/ driveway aprons shall conform to the City of Napa details and specifications.

D. Subgrade and forms shall be wet immediately before concrete placement.

E. Reinforcement shall be carefully placed and supported.

F. Steel dowels, reinforcement steel and welded wire reforcment must comply with Section 52 “Reinforcement” of the California Standard Specifications

G. Apply soil sterilizer 6” each side of the edges of sidewalks/walkways to prevent growth of vegetation under sidewalks/walkways.

H. Excavate for thickened edges where they occur.

3.3 EXISTING CURBS, GUTTERS AND SIDEWALKS

A. Joint shall be cut to a minimum depth of 1-1/2 inches with an abrasive type saw.

B. Joint shall be at first scoring line at or beyond the planned joint location.

3.4 FORMS

A. Smooth face against concrete, true smooth upper edge and rigid enough to withstand pressure of fresh concrete without distortion.

B. Clean and oil coated.

C. Carefully set to alignment, grade and required dimensions.

D. Adequately secured from movement by stakes, clamps, spreaders and braces.

3.5 CURB, GUTTER AND SIDEWALK/WALKWAY CONSTRUCTION

A. Dimensions as shown on Drawings.

B. Public sidewalks/walkways concrete thickness shall conform to City of Napa specifications.

C. Weakened plane joints shall be constructed at intervals not exceeding 15 feet.

D. Expansion joints, 1/2 inch wide, shall be installed where the new walkway joins existing curbs, drainage structures and other fixed objects.

E. Expansion joints shall contain 1/2-inch thick premolded joint fillers the full thickness of concrete. Preformed expansion joint filler must comply with ASTM D 1751.

F. The top and face of curbs, and non-decorative sidewalks/walkways shall be finished with a steel trowel and be given a final fine brush finish.

G. The top and face of curb shall be true and straight and not vary more than 0.01 foot above or below the staked grade.

H. Concrete curing shall be as provided in Section 90-1.03B of the California Standard Specifications.

I. Repairs shall be made by removing and replacing the entire unit between scoring lines or joints.

J. Curb and sidewalk construction in public right-of-way shall be performed under the term of an encroachment permit to be obtained and paid for by the Contractor from the City of Napa.

K. Dowel sidewalks to building slabs at all doorways.

3.6 ADJUST UTILITY BOXES

A. The Contractor shall adjust all existing and new utility boxes, and any other service castings falling within the limits of work to exact grade at the same time the concrete improvements are being constructed and shall maintain these appurtenances to true and exact grade until concrete is thoroughly set.

3.7 CURING

A. Moist Curing: Cover with reinforced waterproof curing paper. Seal all joints and weights down edges. Maintain moist for 14 days.

B. Liquid Curing Compound: Locations as approved by Architect. Apply a uniform coating within two hours of final troweling.

3.8 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete as directed by Architect.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

3.9 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

END OF SECTION

SECTION 32 17 26

CAST IN PLACE DETECTABLE/TACTILE WARNING 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 Section, apply to this Section.

1.2 SUMMARY

A. This Section specifies furnishing and installing Cast In Place Detectable/Tactile Warning Surface Tiles 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 (2) tile samples, minimum 12 inches x 12 inches, of the kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details, composite structural system, tile surface profile, sound on cane contact amplification feature, plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit complete test reports from qualified accredited independent testing laboratory's to quality that materials proposed for use are in compliance with requirements and meet or exceed the properties indicated on the specifications. All tests shall be conducted on a Cast in Place Detectable/Tactile Warning Surface Tile system as certified by a qualified independent testing laboratory and be current within a two year (24 month) period.

E. Maintenance Instructions: Submit copies of manufacturer's specified installation and maintenance practices for each type of Detectable Warning Surface Tile and accessory as required.

1.4 QUALITY ASSURANCE

A. Provide Cast In Place Detectable/Tactile Warning Surface Tiles and accessories as produced by a single manufacturer with a minimum of three (3) years of experience in the manufacturing of Cast In Place Detectable/Tactile Warning Surface Tiles.

B. Installer Qualifications: Engage an experienced Installer certified in writing by Cast In Place Detectable/Tactile Warning Surface Tile manufacturer as qualified for

installation, who has successfully completed installations similar in material, design, and extent to that indicated for Project.

C. Americans with Disabilities Act (ADA): Provide Surface Applied Detectable/Tactile Warning Surface Tiles that comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, 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 2, Section 202 definition of "Detectable Warning". Section 11B-247 and 11B-705 "Detectable Warning and Detectable Directional Texture."

E. Vitrified Polymer Composite (VPC) Cast In Place Detectable/Tactile Warning Surface Tiles shall be an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line pattern of truncated domes measuring nominal 0.2 inch height, 0.9 inch base diameter, and 0.45 inch top diameter, spaced center-to-center 2.35 inch as measured on a diagonal and 1.67 inch as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40-90° raised points 0.045 inch high, per square inch; "Armor-Tile" as manufactured by Engineered Plastics Inc., Tel: 800-682-2525, or approved equal.

F. Dimensions: Cast In Place Detectable/Tactile Warning Surface Tiles shall be held within the following dimensions and tolerances:

Length: 36 inch x 60 inch nominal
Depth: 1.375 (1-3/8 inch) (+/-) 5% max.
Face Thickness: 0.1875 (3/16 inch) (+/-) 5% max.
Warpage of Edge: 0.5% max.
Embedment Flange Spacing: shall be no greater than 3.1 inch

G. Water Absorption of Tile when tested by ASTM D 570-98 not to exceed 0.05%.

H. Slip Resistance of Tile when tested by ASTM C 1028-96 the combined Wet and Dry Static
Co-efficient of Friction not to be less than 0.80 on top of domes and field area.

I. Compressive Strength of Tile when tested by ASTM D 695-02a not to be less than 28,000 psi.

J. Tensile Strength of Tile when tested by ASTM D 638-03 not to be less than 19,000 psi.

K. Flexural Strength of Tile when tested by ASTM D 790-03 not to be less than 25,000 psi.

L. Chemical Stain Resistance of Tile when tested by ASTM D 543-95 (re approved 2001) to withstand without discoloration or staining – 10% hydrochloric acid, urine, saturated

calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, 10% ammonium hydroxide, 1% soap solution, turpentine, Urea 5%, diesel fuel and motor oil.

M. Abrasive Wear of Tile when tested by BYK – Gardner Tester ASTM D 2486-00 with reciprocating linear motion of 37 +/- cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block is to be 3.2 lb. Average wear depth shall not exceed 0.060 after 1000 abrasion cycles when measured on the top surface of the dome representing the average of three measurement locations per sample.

N. Resistance to Wear of Unglazed Ceramic Tile by Taber Abrasion per ASTM C501-84 (re approved 2002) shall not be less than 500.

O. Gardner Impact to Geometry "GE" of the standard when tested by ASTM D 5420-04 to have a mean failure energy expressed as a function of specimen thickness of not less than 550 in. lbf/in. A failure is noted when a crack is visible on either surface or when any brittle splitting is observed on the bottom plaque in the specimen.

P. Accelerated Weathering of Tile when tested by ASTM G 155-05a for 3000 hours shall exhibit the following result - $\Delta E < 4.5$, as well as no deterioration, fading or chalking of surface of tile color No. 33538.

Q. Accelerated Aging and Freeze Thaw Test of Tile and Adhesive System when tested to ASTM D 1037-99 shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles or other detrimental defects.

R. Salt and Spray Performance of Tile when tested to ASTM B 117-03 not to show any deterioration or other defects after 200 hours of exposure.

S. AASHTO HB-17 single wheel HS20-44 loading "Standard Specifications for Highways and Bridges". The Cast In Place Tile shall be mounted on a concrete platform with a 1/2 inch airspace at the underside of the tile top plate then subjected to the specified maximum load of 10,400 lbs., corresponding to an 8,000 lb individual wheel load and a thirty percent (30%) impact factor. The tile shall exhibit no visible damage at the maximum load of 10,400 lbs.

T. Embedment flange spacing shall be no greater than 3.1 inches center-to-center spacing as illustrated on the produce Cast In Place drawing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Cast In Place Detectable/Tactile Warning Surface Tiles shall be suitably packaged or crated to prevent damage in shipment of handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.

B. Cast In Place Detectable Tactile Warning Surface 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 forty degrees Fahrenheit (40°F) in spaces to receive Cast In Place Detectable/Tactile Warning Surface Files for at least two days (24 hours) prior to installation, during installation, and for not less than two days (24 hours) after installation.

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 general public. Provide barricades or screens to protect the general public.

1.7 GUARANTEE

A. Cast In Place Detectable/Tactile Warning Surface Tiles shall be guaranteed in writing for a period of five (5) years from date of final completion. The guarantee defective work, breakage, deformation, fading and loosening of tiles.

PART 2 - PRODUCTS

2.1 DETECTABLE WARNING SURFACES

A. Detectable Warning Surfaces shall comply with CBC Section 11B-705.1

B. Detectable warning surfaces at transit boarding platform edges, bus stops, hazardous vehicular areas, reflecting pools, and track crossings shall be yellow and approximate FS 33538 of Federal Standard 595C. Detectable warning surfaces at other locations shall be either the aforementioned yellow or a color providing a 70 percent minimum visual contrast with that of adjacent walking surfaces. The material used to provide visual contrast shall be on integral part of the surface. CBC Section 11B-705.1.1.3

C. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. Such constraint shall not be required for detectable warning surfaces at curb ramps, islands, or cut-through medians. CBC Section 11B-705.1.1.4

2.2 MANUFACTURERS

A. The vitrified Polymer Composite (VPC) Cast In Place Detectable/Tactile Warning Surface Tile specified is based on Armor-tile manufactured by Engineered Plastics Inc. (800-682-2525). Existing engineered and field tested products, which have been in successful service for a period of three (3) years, are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

B. Color: Yellow conforming to Federal Color No. 23594. Color shall be homogeneous throughout the tile.

PART 3 - EXECUTION

3.1 INSTALLATION

A. During Cast In Place Detectable/Tactile Warning Surface tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. Prior to placement of the Cast In Place Detectable/Tactile Warning Surface Tile system, review manufacturer and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to the Engineer.

C. The specifications of the structural embedment flange system and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers. Not recommended for asphalt applications.

D. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of four (4) to seven (7), to permit solid placement of the Cast In Place Detectable/Tactile Warning Surface Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as two (2) concrete blocks or sandbags, weighing twenty-five pounds (25 lb), shall be placed on each tile.

E. The concrete pouring and finishing operations require typical mason's tools, however, a four (4) foot long level with electronic slope readout, twenty-five pound (25 lb) weights, and a large non-marring rubber mallet are specific to the installation of the Cast In Place Detectable/Tactile Warning Surface Tile system. A vibrating mechanism such as that manufactured by Vibco can be employed, if desired. The vibrating unit should be fixed to a soft base such as wood, at least one square foot (1 sq ft).

F. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.

G. When preparing to set the tile, it is important that no concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Holes in the tile perimeter allow air to escape during the installation process. Concrete will flow through the large holes in each embedment flange on the underside of the tile. This will lock the tile solidly into the cured concrete.

H. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Cast In Place Detectable/Tactile Warning Surface Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting which can result in air voids under the tile surface. The contract drawings indicate that the tile

field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

I. In cold weather climates it is recommended that the Cast In Place Detectable/Tactile Warning Surface Tiles be set deeper such that the top of domes are level to the adjacent concrete on the top and sides of ramp and that the base of domes to allow water drainage. This installation will reduce the possibility of damage due to snow clearing operations.

J. Immediately after placement, the tile elevation is to be checked to adjacent concrete. The elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates. Ensure that the field surface of the tile is flush with the surrounding concrete and back of curb so that no ponding is possible on the tile at the backside of curb.

K. While concrete is workable, a 3/8 inch radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile

L. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile that may rock the tile causing a void between the underside of tile and concrete.

M. Following tile placement, review installation tolerance to contract drawings and adjust tile before the concrete sets. Two suitable weights of twenty-five pounds (25 lbs) each may be required to be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.

N. Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.

O. If desired, individual tiles can be bolted together using ¼ inch or equivalent hardware. This can help to ensure that adjacent tiles are flush to each other during the installation process. Tape or caulking can be placed on the underside of the bolted butt joint to ensure that concrete does not rise up between the tiles during installation. Any protective plastic wrap that was peeled back to facilitate bolting or cutting, should be replaced and taped to ensure that the tile surface remains free of concrete during the installation process.

P. Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.

Q. Any sound-amplifying plates on the underside of the tile, which are dislodged during handling or cutting, should be replaced and secured with construction adhesive. The air gap created between these plates and the bottom of the tile is important in

preserving the sound on cane audible properties of the Armor-Tile system as required in various jurisdictions.

3.2 CLEANING, PROTECTING AND MAINTENANCE

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 schedules for inspection intended to establish date of substantial completion in each area of project. Clean Tactile Tile by method specified by Tactile Tile manufacturer.

D. Comply with manufacturers maintenance manual for cleaning and maintaining tile surface and it is recommended to perform annual inspections for safety and tile integrity.

END OF SECTION

SECTION 32 31 14

VINYL COATED CHAIN LINK FENCE & GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide complete chain link fencing and gates as shown on the drawings and as specified.

B. Related requirement specifications elsewhere:
1. Section 32 13 12, landscape Concrete

1.2 QUALITY ASSURANCE

A. Reference Standards
1. State of California Department of Transportation (Caltrans), "Standard Specifications."
2. Manufacturer's recommendations and specifications.
3. ASTM A36 Standard Specification for Carbon Structural Steel
4. ASTM A392 Standard Specification for Zinc-Coated Steel Chain-Link Fabric
5. ASTM A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-dip Galvanized Coatings
6. ASTM A817 Standard Specification for Metallic-Coated Steel Wire for Chain Link Fence Fabric and Marcelled Tension Wire
7. ASTM A824 Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link
8. ASTM F552 Standard Terminology Relating to Chain Link Fencing
9. ASTM F567 Standard Practice for Installation of Chain Link Fence
10. ASTM F626 Standard Specification for Fence Fittings
11. ASTM F668 Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain Link Fence Fabric
12. ASTM F900 Standard Specification for Industrial and Commercial Swing Gates
13. ASTM F1043 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
14. ASTM F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
15. ASTM F1664 Standard Specification for Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used With Chain Link Fence
16. WLG2445 Chain Link Fence Manufacturers Institute, Chain Link Fence Wind Load Guide for the Selection of Line Posts and Line Post Spacing
17. Local City or County Codes, whichever is more stringent.

1.3 SUBMITTALS: Per Section 01 30 00.

A. Shop drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.

B. Product data: Manufacturer's catalog cuts indicating material compliance and specified options.

C. Submit sample of each fabric size and color if requested.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company having manufacturing facilities in the United States with 5 years experience specializing in manufacturing of chain link fence products.

B. Fence contractor: Contractor having 5 years experience installing similar projects in accordance with ASTM F567.

C. Single source: To ensure system integrity obtain the chain link system, framework, fabric, fittings, gates and accessories from a single source.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Anchor Fence/Master Halco Inc., Baltimore MD (800) 229-5615 (specified); Boundary Fence & Railing Systems, Richmond Hill, NY (800) 628-8928; or Approved Equal.

B. Manufacturer: Company shall have manufacturing facilities in the United States with a minimum 5 years experience specializing in manufacturing of chain link fence products.

2.2 FENCE SYSTEMS

A. CHAIN LINK FENCE: Round Schedule 40 vinyl coated galvanized steel frame with concrete post footings, round rail at top and at bottom, and 9-gauge, 2" mesh, vinyl coated galvanized chain link fabric. All rods, bars, bands, clips, bolts, tension wire, and other fittings shall be vinyl coated.

2.3 MATERIALS

A. Conform to Caltrans Standard Specifications, Section 80, except as required otherwise herein:
   1. Fabric: Hot-dipped galvanized after weaving, conforming to ASTM A116-88. Tensile strength of fabric shall be 80,000 psi minimum. Fabric shall be knuckled top and bottom, single width fabric to full height of fence. 9-gauge wire size plus vinyl fused-bonded color coating. Vinyl bonded fabric shall be fused-bonded with a PVC coating of 7 to 12 MILS (.007" to .012") per ASTM- F668 Class 2B.
   2. Color of chain link fabric per ASTM F934 as shown on Drawings.

3. Steel pipe: All fence frame posts, rails, braces, shall be round pipe ASTM F1043 Group IA, ASTM F1083 standard weight schedule 40 hot-dip galvanized pipe having a zinc coating of 1.8 oz/ft² (550 g/m²) on the outside and 1.8 oz/ft² (550 g/m²) on the inside surface.
4. Exterior of galvanized pipe to have F1043 PVC thermally fused color coating, minimum thickness 10 mils (0.254 mm).
5. All fittings to be PVC thermally fused color coated having a minimum thickness of 0.006" (0.152 mm) per ASTM F626. PVC color to match fabric and framework. Moveable parts, nuts and bolts to be field coated with PVC liquid touch up after installation. Provide approved fused-bonded vinyl finish pivots and latch with eyes for padlocking (padlock N.I.C.). Provide fused-bonded vinyl finish cane bolt at both leaves of gate.
6. Truss rod assembly: Fused-bonded vinyl finish galvanized steel minimum 5/16" diameter truss rod with pressed steel tightener, in accordance with ASTM F626
7. Post caps: ASTM F626 galvanized pressed steel, malleable iron, or aluminum alloy weather tight closure cap for tubular posts with fused-bonded vinyl finish. Provide one cap for each post. When top rail is specified provide line post loop tops to secure top rail.
8. Tension wire: Poly Vinyl Chloride (PVC) coated metallic coated steel tension wire per ASTM F 1664, 7 gauge steel core wire, 0.177", PVC coating class and color to match chain link fabric
9. Rail ends: Galvanized pressed steel per ASTM F626, for connection of rails to post using a brace band.
10. Top rail sleeves: 7" (178 mm) galvanized steel sleeve per ASTM F626. If expansion and contraction of the rail is of concern add a 0.137" wire diameter by 1.80" long expansion spring between the adjourning rails]
11. Wire ties: 9 gauge (0.148") galvanized steel wire for attachment of fabric to line posts and rails. Pre-formed hog ring ties to be 9 gauge (0.148") galvanized steel or aluminum for attachment of fabric to tension wire. Tie wire and hog rings PVC coated and in compliance with ASTM F626. Color to match fabric color.
12. Concrete: Minimum 28 day compressive strength of 3,000 psi.

B. Fence Post Schedule:

	END & CORNER POSTS		LINE POSTS			
FENCE HEIGHT	POST SIZE (O.D.)	FOOTING DEPTH & DIA.	POST SIZE (O.D.)	FOOTING DEPTH & DIA.	HORIZONTAL RAIL (O.D.)	MAXIMUM POST SPACING
4-6' MAX.	2 ½" 3.65 lb/ft	10" dia. 30" deep	2" 2.72 lb/ft	10" dia. 30" deep	1 5/8" 2.27 lb/ft	10'-0" o.c.

C. Above post footing sizes indicate a post bury to a minus 4 inches from bottom of footing. Where center rails are required, provide braces and trusts top and bottom panels.

D. Gate Post Schedule (6' maximum height gates):

Gate Opening	Gate Post Size	Gate Post Footing Size
to 6' wide	3" o.d.(5.79 lb/ft)	12" dia. x 36" deep

2.4 VINYL COATED CHAIN LINK SWING GATE

A. Swing gates as shown on Drawings. Fabricate chain link swing gates in accordance with ASTM F900. Gate frame to be of welded construction. Weld areas to be protected with zinc-rich paint per ASTM A780. The gate frame members are to be spaced no greater than 8’ 0” apart horizontally or vertically. Exterior members to be 1.900” OD pipe, interior members when required shall be 1.660” OD pipe. Pipe to be Schedule 40. Chain link fabric to match specification of fence system. Fabric to be stretched tightly and secured to vertical outer frame members using tension bar and tension bands spaced 12” on center and tied to the horizontal and interior members 12” on center using 9 gauge galvanized steel ties.

B. Hinges, hot dip galvanized pressed steel or malleable iron, structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180°.

C. Latch: Galvanized forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.

D. Gates: Provide galvanized drop rod with center gate stop pipe in concrete base or receiver to secure inactive double gate leaf in the closed position. Provide galvanized pressed steel locking latch, requiring one padlock for locking single gate leaf and both double gate leaves, accessible from either side.

E. Gate holdback: Provide galvanized gate hold back keeper for each gate leaf over 4' wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position, similar to gate stop pipe in concrete base.

2.5 EXIT GATE ACCESSORIES AND HARDWARE

A. General: Gates that are part of the accessible path of travel shall comply with Section 1133B.1.1.1.4 of the California Building Code.

B. Panic Hardware and Levers: Exit gates, excluding double swing gates not in path of travel, in the chain link fence shall include lever or panic hardware to comply with Section 1133B.2.5.2 of the of the California Building Code.

C. Gate Bottom: The bottom 10 inches of the exit gates in the chain link fence shall have a smooth, uninterrupted surface to allow the gate to be opened by a wheelchair footrest without creating a trap or hazardous condition to comply with the requirements of Section 1133B.2.6.Smooth Surface of the of the California Building Code.

PART 3 - EXECUTION

3.1 SITE EXAMINATION

A. Ensure property lines and legal boundaries of work are clearly established.

B. Survey of fence location to be provided by general contractor.

C. Verify areas to receive fencing are completed to final grade.

3.2 FENCE FABRICATION AND ERECTION: Shall be in accordance with Caltrans Standard Specification Section 80, except as otherwise specified herein:

A. Post Installation: Set posts in undisturbed or compacted soil, evenly spaced, plumb and true to lines with top line uniform in concrete to depths herein specified. End, corner, pull and gate posts to be braced with same material as top rail and trussed to line posts with 3/8" rods and tighteners. Line posts shall be evenly spaced 10' or less as specified. Top rail shall pass through line post tops and form a continuous brace within each stretch and be securely fastened to terminal posts. Splices in top rail shall be made with couplings at approximately 20' spacing. Set each post in 3,000 psi concrete footing sized in accordance with above Fence Schedule.

B. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

C. Bracing: Install horizontal brace and truss assembly at mid-height or above for fences 6’ and over at each fabric connection to the terminal post. The diagonal truss rod is installed at the point where the brace rail is attached to the terminal post and diagonally down to the bottom of the adjacent line post. Place the truss rod in tension by adjusting the turnbuckle.

D. Except as required otherwise, set top of concrete footing flush with grade and trowel smooth to slope away from post to drain. Post to extend to 4" from bottom of concrete footing. Allow concrete footings to cure 5 days before erection of fabric.

E. Tension wire: Install tension wires so that it will be located 4” up from bottom the fabric. If top rail is not required, install the tension wire so that it will be located 4” down from the top of the fabric. Stretch and install tension wire before installing the chain link fabric and attach it to each post using wire ties.

F. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces.
   1. Remove all metal shavings from cut area.
   2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
   3. Apply 2 coats of custom finish paint matching fence color..

3.3 GATES:

A. Shall be structurally stable vertically and laterally, in any position.

B. Gate openings shown on plans to be face-to-face dimension of gate posts. Swing of gates to be as shown. Contractor shall verify grade conditions at bottom of gate and submit shop drawings that respond to field conditions.

C. Provide shop drawings indicating necessary rail sizes and trussing appropriate for gate opening. Supply gates with positive-type latching devices with provisions for padlocking. After hinges are placed, final adjustments made, and bolts tightened, the hinge clamp and gate post at each location shall be mutually drilled and tapped, and 1/4" machine bolt set to lock hinge in position. This applies to all hinges.

3.4 RAILS:

A. Make splices at top rails with couplings at approximately every 20'. Coupling shall produce a continuous brace of railing from end to end of each stretch of fence. Every fifth coupling in a stretch shall be fitted with a heavy spring to allow for expansion and contraction of rail. Rigidly clamp rails to end and corner post with appropriate fittings. Clamp mid-rail and bottom rail at each post using rail end or line rail clamps.. Stretch all fabric tight, free from sags and bulges.

B. Secure fabric using wire ties to line posts at 14” on center and to rails and braces 24” on center, and to the tension wire using hog rings 24” on center. Tie wire shall be secured to the fabric by wrapping it two 360 degree turns around the chain link wire pickets. Cut off any excess wire and bend back so as not to protrude so as to avoid injury if a pedestrian may come in contact with the fence.

3.5 CHAIN LINK GATE INSTALLATION

A. Swing gates: Installation of swing gates and gate posts shall be per ASTM F567. Direction of swing shall be as shown on drawings. Gates shall be hung plumb in the closed position with minimal space from grade to bottom of gate leaf. Double gate drop bar receiver shall be set in a minimum concrete footing 8" diameter by 24” deep. Gate leaf holdbacks shall be installed on all double gates and all gate leafs greater than 5’ in width.

3.6 CLEANING: .

A. Clean up area adjacent to fence line from debris and unused material created by fence installation. Remove any concrete splash from fence posts.

END OF SECTION

SECTION 32 33 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install all site furnishings shown on drawings and specified in accordance with the manufacturer's instructions and as shown on the drawings and as specified.

B. Related requirement specifications elsewhere:
   1. Section 32 13 12, LANDSCAPE Concrete

1.2 REFERENCES

A. Perform work in accordance with all applicable laws, codes and regulations required by the City and the State of California.

B. Manufacturer’s Instructions:
   1. Where required in the Specifications that materials, products, processes, equipment or the like to be installed or applied in accordance with manufacturer’s instructions, directions or specifications, or words to this effect, it shall be constructed to mean that said application or installation shall be in strict accordance with printed instructions furnished by the manufacturer of the material for use under conditions similar to those at the job site.
   2. All site furnishings shall be anchored or otherwise secured to prevent movement, unless stated otherwise. Provide concrete footings, corrosion resistant clips, etc. as accepted by the Owner's Representative.

C. Reference Standards:
   1. State of California, Business and Transportation Agency, Department of Transportation: “Standard Specifications.”
   2. Manufacturers’ specifications and recommendations.

1.3 COORDINATION

A. Coordinate items of other trades. Contractor shall be responsible for the proper installation of all accessories embedded in concrete and for the provision of connections, holes, openings, etc., necessary to the execution of the work of the trades.

1.4 SUBMITTALS: Section 01 30 00

A. Benches, including required leveling spacers, wood sample, and certified FSC 100% documentation.

B. Recycling Receptacles, including required leveling spacers, finishes and color samples.

C. Bike Racks, including finishes and color samples.

D. Tree Grates, including finishes and color samples.

E. Tables and Chairs, including wood, finishes and color samples.

F. Skate Deterrent, full size mock-up including finish and color.

PART 2 - MATERIALS

2.1 BENCHES

A. Bench Type 1 Model: Heavy Heavy, 92” Length, 24” depth manufactured by Streetlife Studio America. www.streetlifeamerica.com

B. Bench Type 2 Model: Heavy Heavy, 118” Length, 24” depth, back length 98.5”, manufactured by Streetlife Studio America. www.streetlifeamerica.com

C. Skate Deterrent - First beam to receive cut out notch skate deterrent.

D. Wood: FSC 100% Core hardwood beams
1. Species: Basralocus wood (Dicorynia guianensis)

E. Finishes
1. Bench support: hot dip galvanized steel untreated, G100.
2. Bench beams: hardwood untreated, natural weathering on site
3. Benches to be sanded on-site to be smooth with sandpaper G80 in the direction of the wood grain per manufacturer’s recommendations.

2.2 RECYCLING RECEPTACLE

A. Model: Lakeside Litter Receptacle Side-opening 30 gallons, Plain, 36” height by 21” diameter, surface mount, with liner by Landscape Forms, Inc www.landscapeforms.com.

B. Finish: Landscape Forms ‘Pangard II’, color silver

C. Signage: Laser cut on each group of 2 ‘RECYCLING’ in custom front panel.

2.3 BIKE RACK

A. Model: Ring, embedded, 1.5” depth x 25” depth x 27” height, by Landscape Forms, Inc www.landscapeforms.com.

B. Finish: Stainless steel

2.4 TREE GRATE

A. Model: Jamison, 5ft sq, with 1’-7” knockout, by Urban Accessories, Inc., 465 East Fifteenth Street, Tacoma, WA 98421 – PH: (253) 572-1112 or sales@urbanaccessories.com.

B. Tree Grate material shall be high quality, 100% recycled, cast grey iron, per ASTM A48 class 35b or better; hardness 170-223 brinnell.

C. Finish on Tree Grates shall be Rust Converter.

D. Tree Grate Frames shall be Type “S” Frames, for embedded installation into new concrete surround.

E. Tree Grate Frame material shall be mild steel angle iron and other shapes as necessary, per ASTM A36

F. Finish on Tree Grate Frames shall be Rust Converter.

2.5 TABLE AND CHAIRS

A. Tangent Table Ensemble by Forms+Surfaces, 30 Pine Street,Pittsburgh, PA 15223, phone: 800-451-0410, email: sales@forms-surfaces.com, website: www.forms-surfaces.com.

B. Materials:
1. Frames: cast aluminum and extruded aluminum.
2. Table Tops: 48" across, stainless steel, without a center hole to receive a 1.75" diameter umbrella pole. ADA-compliant.
3. Seat Type: Backed.
4. Seats: FSC 100% Cumaru hardwood slats.
5. Fasteners: stainless steel.

C. Finishes:
1. Ensemble frame: Cast aluminum and extruded aluminum: polyester powdercoat
    1) Argento Texture from Forms+Surfaces Powdercoat Chart.
2. Seats: FSC 100% Cumaru hardwood slats: natural oiled finish.
3. Table Tops: Powdercoat finish
    1) Polyester powdercoat: Argento Texture from Forms+Surfaces Powdercoat Chart.
    2) Without a center hole to receive a 1.5" (38 mm) diameter umbrella pole.
4. Dimensions: Four-seat ensembles with backed seats.
    1) Overall: 57.2" diameter, 32.9" height, 29.3" table height.
    2) Seats: 18.0" wide x 20.2" deep x 18.1" high.
5. Installation: Surface mount. Stainless steel anchors and mounting bolts are sold separately.

2.6 SKATE DETERRENTS

A. Model:for concrete seatwalls and retaining walls

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install manufactured items in accordance with the manufacturer's instruction and as shown in the drawings and as specified herein.

B. Perform all work in accordance with all applicable laws, codes and regulations required by State of California.

C. Set all work true and square, plumb and level. Remove and replace any wood that splits during or after erection until acceptance. Keep nailing neatly lined up.

D. Fabricate wood in as long pieces as practical unless otherwise indicated. End joints shall occur at supports. Keep all work clean, accurately cut, closely fitted and set to the required lines and levels. Blunt exposed edges by sanding or with plane.

E. Place washer under the head and nut of bolts where same bear on wood, except head of carriage bolt. Drill bolt holes same diameter as bolt.

F. Size bolts to fit flush with nuts. Countersink nuts and bolts as detailed.

G. Hammers with scored faces shall not be used in nailing.

H. Supply all miscellaneous metal units and install as specified herein under the Sections entitled "Miscellaneous Metalwork" and "Galvanizing." Hot-dip galvanize all metal fastenings, angles, etc., after complete fabrication.

I. Galvanized metal that is cut, damaged or modified after fabrication shall be immediately painted with Zinc-rich paint to prevent rusting.

J. Touch up paint any damaged surfaces to match original finish as accepted by Owner's Representative.

K. Set site furniture, level. Provide spacers under furniture to level as specified herein and acceptable to Owner’s Representative

L. Transport, store and handle precast units and manufactured items in a manner to avoid hairline cracks, staining or other damage. Store units free of the ground and protected from mud or rain splashes. Cover units, secure covers firmly, and protect the units from dust, dirt or other staining material.

3.2 BENCHES

A. Install level and in accordance with the manufacturer's instruction and as shown.

B. Sand benches on-site to be smooth per manufacturer's instructions.

3.3 RECYCLING RECEPTACLES

A. Install level and in accordance with the manufacturer's instruction and as shown. Provide spacers under receptacles to level as specified and acceptable to Owner’s Representative.

3.4 BIKE RACK

A. Install flush in concrete and in accordance with the manufacturer's instruction and as shown.

3.5 TREE GRATES

A. Install in accordance with the manufacturer's instruction and as shown.

3.6 TABLES AND CHAIRS

A. Install in accordance with the manufacturer's instruction and as shown.

3.7 SKATE DETERRENTS

A. Install with concrete seatwall and retaining wall edges and as shown.

END OF SECTION

SECTION 32 84 00

IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section consists of furnishing, layout and installing a 2-wire irrigation system complete, including certification of irrigation system installation as required by the State of California Model Water Ordinance described herein.

B. Related work specified elsewhere includes:
1. Section 31 00 00, EARTHWORK
2. Section 32 90 00, PLANTING
3. Section 26 00 00, ELECTRICAL (stub-out for controllers).

1.2 CALIFORNIA MODEL WATER EFFICIENT LANDSCAPE ORDINANCE REQUIREMENTS

A. Contractor shall be familiar with and follow the State of California Model Water Ordinance, California Code of Regulations, Title 23 Waters, Division 2, Department of Water Resources, Chapter 2.7. Also, the Contractor is responsible to follow all local water ordinances.

B. Pursuant to the requirements of the California Model Water Efficient Landscape Ordinance, the Contractor shall submit a Certification of Installation to the Local Jurisdiction /water purveyor as described in the construction documents and these specifications. Certification shall at a minimum include the following documents:

PART 1. Project Information Sheet
PART 2. Certification of Installation according to the landscape documentation package.
PART 3. Irrigation Scheduling and Controller Programming
PART 4. Schedule of Landscape and Irrigation
PART 5. Landscape Irrigation Audit Report
PART 6. Soil Management/Analysis Report with verifying implementation, see Planting Specification for analysis requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer's Specifications: Follow manufacturer's current printed specifications and drawings in all cases where the manufacturers of articles used in the Contract furnish directions covering points not specified or shown in the drawings.

B. Ordinances and Regulations: All local, municipal and state laws, codes and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the above codes, regulations or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship or construction of a better quality, higher standard, or larger size than is required by the above codes and regulations, the provisions of these Specifications and Drawings shall take precedence. Furnish without extra charge additional materials and labor required to comply with above rules and regulations.

C. References, Codes and Standards:
1. State of California Model Water Efficient Landscape Ordinance
2. California Environmental Quality Act (CEQA)
3. Water Use Classification of Landscape Species (WUCOLS IV).
4. American Society of Irrigation Consultants (ASIC) Design Guidelines.
5. California Landscape Standards, California Landscape Contractors Association, (CLCA) Sacramento, California.
6. CAL-OSHA, Title 8, Subchapter 4-Construction Safety Orders and Subchapter 7-General Industry Safety Orders.
7. California Electric Code.
8. California Plumbing Code (UPC) published by the Association of Western Plumbing Officials.
9. NFPA 24, Section 10.4, Depth of Cover.
10. Underwriters Laboratories (UL): Electrical wiring, controls, motors and devices, UL listed and so labeled.
11. American Society of Testing Materials (ASTM).

D. Furnish without extra charge any additional material and labor when required by the compliance with all above mentioned codes and regulations, though the work be not mentioned in these specifications or shown on the drawings.

E. Reclaimed Water: Contractor to coordinate with owner and water purveyor to determine if reclaimed water is available or planned for prior to the commencement of installing the irrigation system to coordinate inspection of the work and to verify all codes and regulations regarding use of reclaimed water. If reclaimed water is to be utilized, contractor to provide all pipe, equipment, signage and other warnings for reclaimed as required by local agency regulations.

F. Experience: Assign a full-time employee to the job as supervisor for the duration of the Contract with a certified landscape technician, irrigation certification through CLCA or minimum of four (5) years experience in landscape irrigation installation.

G. Labor Force: Provide a landscape installation and maintenance force thoroughly familiar with, and trained in, the work to be accomplished to perform the task in a competent, efficient manner acceptable to the Owner's Representative.

H. Explanation of Drawings:
1. Due to the scale of the Drawings, it is not possible to indicate all piping offsets, fittings, sleeves, etc., which may be required. Carefully investigate

the conditions affected all of the work and plan accordingly, and furnish all required fittings. Install system in such a manner to avoid conflicts with planting, utilities and architectural features.

2. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences or discrepancies in arc dimensions exist that might not have been considered in engineering. Bring such obstruction or differences to the attention of the Owner's Representative. Notify and coordinate irrigation Work with applicable contractors for location and installation of piping and sleeves through or under walls, pavement and structures. In the event this notification is not given, the Contractor shall assume full responsibility for any revision necessary.

I. Trench Interference with Tree Root Systems:
   1. Prior to trenching, layout main and lateral line locations within Drip Line of trees and review locations with Owner's Representative. Relocate any lines that may interfere with existing root systems to avoid or reduce damage to root systems as accepted by Owner's Representative.
   2. Mechanical Trenching is not allowed within dripline of existing trees to be protected except as approved by Landscape Architect

J. Coordinate plant locations with emitter locations.
   1. Adjust plant locations in relation to the subsurface emitter s as required to ensure that the plant roots receive the proper amount of water in order for it to thrive.
   2. Coordinate planting and irrigation and provide hand watering of emitter irrigated and drip irrigated areas as required to maintain moist root zones until end of plant establishment period.

1.4 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings show, if applicable, existing above and below grade structures and utilities that are known to the Owner. Locate known existing installations before proceeding with construction operations that may cause damage to such installations. Existing installations shall be kept in service where possible and damage to them shall be repaired with no adjustment of Contract Sum. Verify with Owner if As Built drawings are available.

B. If other structures or utilities are encountered, request Owner's Representative to provide direction on how to proceed with the Work. If a structure or utility is damaged, take appropriate action to ensure the safety of persons and property.

1.5 SUBMITTALS, in accordance with Section 01 30 00.

A. Materials List:
   1. Submit required copies of the cut sheets and a complete list of materials proposed for installation, along with any proposed substitutions clearly identified and obtain the Owner Representative's written approval thereof before proceeding. Use only accepted materials and items of equipment.
   2. List all materials by manufacturer's name and model number.

3. Submit to Local Water Purveyor with copy to the Owner Certification of Installation as required by the State of California Model Water Ordinance.

B. Substitutions:
   1. If the Contractor desires to substitute a product, he shall list each item and note it as a "substitution" and provide the following information:
      a. Descriptive information describing its similarities to the specified product.
   2. If the product is approved and, in the opinion of the Owner's Representative, the substituted product does not perform as well as the specified product, the Contractor shall replace it with the specified product at no additional cost to the Owner.

C. Operations and Maintenance Manuals:
   1. Prior to the final acceptance of the irrigation system, furnish three (3) individually bound Operation and Maintenance Manuals to the Owner's Representative for use by the Owner. The manuals shall contain complete enlarged drawings, diagrams and spare parts lists of all equipment installed showing manufacturer's name and address. In addition, each Service Manual shall contain the following:
      a. Index sheet indicating the Contractor's name, address and phone number.
      b. Copy of the Landscape Irrigation Audit
      c. Copy of the 12-month irrigation schedule and estimate of annual water consumption
      d. Copies of equipment warranties and certificates.
      e. List of equipment with names, addresses and telephone numbers of all local manufacturer representatives.
      f. Complete operating and maintenance instructions in sufficient detail to permit operating personnel to understand, operate and maintain all equipment.
      g. Parts list of all equipment such as controllers, piping, backflow preventer, flow sensor, decoders, valves, solenoids, surge protection, wiring, spray heads and driplines.

D. As-Built Drawings:
   1. Dimension the location of the following items from two (2) permanent points of reference such as building corners, sidewalks, road intersections, etc.:
      a. Connection to existing water lines/meter.
      b. Connection to electrical power.
      c. Gate valves.
      d. Routing of irrigation pressure lines (a dimension at least every 100 feet and as required to identify all changes in direction and location).
      e. Remote control valves.
      f. Routing of control valves.
      g. Quick coupling valves.
      h. All sleeve locations.
      i. Routing of all control wiring.
      j. Include all invert elevations below 12".
   2. Deliver a reproducible As-Built Drawing to the Landscape Architect or Owner’s Representative within seven (7) working days before the date of

final review. Delivery of the record drawings shall not relieve the Contractor of the responsibility of furnishing required information in the future.

E. Controller Plan:
1. Provide one Irrigation Diagram plan in each controller housing. The plan shall show the area controlled by each valve in different colors and for orientation, any major permanent structure such as buildings and roads.
2. Charts to be waterproof and hermetically sealed between two pieces of transparent 10 mil thick plastic and installed in each controller on the door as accepted by the Owner's Representative no later than the time of the coverage test of the irrigation system.

F. Maintenance Material - supply the following tools to the Owner:
1. Three (3) sets of specialized tools required for removing, disassembling and adjusting each type of sprinkler, valve or other equipment supplied on this project.
2. Two (2) keys for each type of equipment enclosure.
3. Two (2) keys for each type of automatic controller.
4. Two (2) keys for each type of valve (including square type key for valves larger than 2”)
5. Two (2) quick-coupler keys and matching hose swivels for each type of quick-coupling valve installed.
6. All lock keys shall be keyed alike.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Furnish and deliver materials in manufacturer's packaging, bearing original legible labeling.

B. The Contractor is cautioned to exercise care in handling, loading, unloading, and storing PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of the pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been dented, cracked, or otherwise damaged shall be discarded and, if installed, shall be replaced with new piping.

1.7 SEQUENCING AND SCHEDULING

A. Acceptance: Do not install main line trenching prior to acceptance by Owner's Representative of rough grades completed under another Section.

B. Coordination: Coordinate with the work of other sections to insure the following sequence of events:
1. Sleeves and Conduits: Installation of all sleeves and conduits to be located under paving and through walls prior to placement of those materials.
2. Bubbler Heads: Install after placement of tree, but prior to backfill with planter soil mix.
3. Coordinate work schedule with Owner to avoid disruption of landscape maintenance of existing landscaping.
4. Install piping prior to soil preparation (planting soil amendment installation).

1.8 WARRANTY.

A. In addition to manufacturer's guarantees and warranties, work shall be warranted for one (1) year from date of final acceptance against defects in material, equipment and workmanship. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment and workmanship to the satisfaction of the Owner.

B. Include a copy of the warranty form in the Operation and Maintenance Manual.

1.9 OPERATION

A. Routine: Inspect and adjust all spray heads and control valves including raising or lowering of spray head heights to accommodate plant growth and weather conditions.

B. Controller: Inspect regularly for power interruption and reset clock as required. Adjust station timing to accommodate changes in plant growth and weather conditions.

C. System Failure: Perform all repairs within one (1) operating period. Replacements to match removed products and materials in all respects. Report promptly all damage not resulting from Contractor's operations. Repair all damage caused by Contractor at no expense to Owner.

D. Climate Change: Set and program automatic controllers in response to seasonal requirements and requirements of newly planted materials.

PART 2 - PRODUCTS

2.1 PIPE

A. Pressure Main Line Pipe and Fittings: All PVC fittings shall bear the manufacturer's trademark name, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

B. All main line pipe shall be solvent welded and manufactured from purple-colored PVC material and shall be printed on two sides with the wording "CAUTION-RECLAIMED WATER" every 24 inches along pipe.

1. PVC Pressure Rated Pipe: ASTM D2241 NSF approved Type I, Grade I, solvent welded PVC with an appropriate standard dimension ratio (S.D.R.).
2. PVC Scheduled Pipe: ASTM D1785 NSF approved, Type I,
3. Grade I, solvent welded PVC.
4. PVC Solvent-weld Fittings: ASTM D2466 Schedule 40, 1-2, II-I NSF approved.
5. Solvent Cement and Primer for PVC solvent-weld pipe and fittings: Type and installation methods prescribed by the manufacturer.

Connections between Main Lines and RCVs: Schedule 80 PVC (threaded both ends) nipples and fittings unless required otherwise by local jurisdiction.

C. All lateral line pipe shall be solvent welded Schedule 40 manufactured from purple-colored PVC material and shall be printed on two sides with the wording "CAUTION-RECLAIMED WATER" every 24 inches along pipe.

2.2 CONDUITS & SLEEVES

A. Sleeving shall be Schedule 40 PVC pipe sleeves and a minimum of two times the aggregate diameter of all pipes contained within the sleeve. Provide Schedule 40 PVC 1.25” conduit for entire two-wire system. Provide vertical sweep for all electrical conduit on each side of hardscape and terminate ends at 12" minimum depth and 12" from hardscape surface.

2.3 CONTROLLERS(S):

A. Wall-mounted irrigation controller, as shown on drawings, and with the following minimum requirements.

B. Shall be weather-based and be compatible with rain shut off sensor.

C. Shall be user-friendly. The controller must have a minimum 20-character readout display describing actions or options, or a full visible panel of buttons, dials, or switches that control all different functions separately.

D. Shall have the ability to start a programmed sequence of valves a minimum of 5 times a day per program.

E. Shall have ability to easily and quickly change watering schedules due to change in weather.

F. Provide portable hand-held remote device compatible with controller and capable of operating all control valves.

G. Provide rain shut off device as manufactured by Control System manufacturer capable of shutting off all control valves. Locate in a location exposed to rain and hardwire to controller.

2.4 CONTROLLER GROUND

A. Provide each pedestal controller with its own ground rod. Separate the ground rods by a minimum of eight feet. The ground rod shall be an eight foot long by 5/8" diameter U.L. approved copper clad rod or as recommended by controller manufacturer. Install no more than 6" of the ground rod above finish grade. Connect #6 gauge wire with a U.L. approved ground rod clamp to rod and back to ground screw at base of controller with appropriate connector. Make this wire as short as possible, avoiding any kinks or bending. Install within pedestal housing base unless otherwise noted.

B. Provide each irrigation controller with its own independent low voltage common ground wire.

2.5 CONTROLLER ENCLOSURES

A. Type: Use one of the following (unless noted otherwise on the Drawings). Verify correct equipment to fit the specified equipment:
   1. Stainless steel, NEMA Type 3 rated, with back panel, padlocking hasp and padlock Rain Bird, Le Meur, “Strong Box” or approved equal. See Detail for pedestal construction.
   2.

2.6 MASTER CONTROL VALVE

A. Master control valve shall be a 24 VAC, industrial type, solenoid control valve, Griswold 2000 series or equal. Valve shall be equipped with spring loaded packless diaphragm, cast iron body and bronze trim. The valve shall be of the normally open type and shall be equipped with four-prong (cross) flow control. Valve shall be slow closing without chatter settings or adjustment. Valve shall have a mechanical self-purging internal control system with tapered, serrated, scrubbing rod through diaphragm for positive, variable port opening and cleaning. No solenoid port screens. Valve solenoid shall be corrosion-proof, molded in epoxy to form one integral unit with no connection shunts and shall be 24 VAC, 3 watt maximum.

2.7 FLOW SENSORS

A. Compatible with controller and as recommended by controller manufacturer, unless as shown on the Drawings.

2.8 ISOLATION VALVE:

A. Valves 3 inches and smaller: 125 lb. WSP bronze gate valve with screw-in bonnet, non-rising stem and solid wedge disc, NIBCO T-113 K, or approved equal. Valves shall be line size.

B. Valves larger than 2”: shall have square nut stem and o-ring connections for key operation.

2.9 QUICK COUPLER VALVES:

A. Quick coupler valves shall be equipped with purple covers. Box shall have purple color lid (unless noted otherwise), with marked “irrigation” and with bilingual non-potable warning and symbol

2.10 BOX FOR ISOLATION & QVALVE & QUICK COUPLER VALVES

A. 10" diameter black plastic, Ametek, Brooks, Christy, Rain Bird with bolt down black lid marked "irrigation," or accepted equal. Avoid locating valve in paved areas. Provide H/20 Loading concrete box with bolt-down concrete lid if valve is located in paved area. Obtain location approval by Owner's Representative.

B. Isolation valves shall be equipped with purple covers. Box shall have purple color lid (unless noted otherwise), with marked “irrigation” and with bilingual non-potable warning and symbol

2.11 REMOTE CONTROL VALVE: As shown on Drawings and with the following minimum requirements:

A. Remote control valves shall be those normally manufactured for irrigation systems and shall have a slow, consistent speed of closure through entire closing operation, including last portion. To ensure this, the effective diaphragm working area/valve seating opening ratio must be a minimum 3 to 1.

B. Shall be mechanically self-cleaning to help prevent diaphragm or solenoid port plugging. To ensure this, the flush rod should be tapered to vary the size of the port opening as the diaphragm raises and lowers, thus allowing trapped material to escape. Rod is to be finished with a serrated surface to help scrub trapped material out. Screens not acceptable.

C. Shall have removable valve seat so valve can be repaired without removal from irrigation line.

D. Shall have ability to operate manually without the use of wrenches or special keys.

E. Shall have one-piece solenoid that attaches directly to valve without shunts or clips that can be lost.

F. Shall have cross top handle to adjust maximum travel of diaphragm to allow "tuning" of valve and closure.

G. Remote control valve to contain non potable purple cap.

2.12 BOX FOR REMOTE CONTROL VALVE

A. Rectangular black plastic valve box - Ametek, Carson, Christy, Rain Bird or accepted equal with non-hinged bolt down black (purple for non potable water) colored lid marked “irrigation” (and with bilingual non-potable warning and symbol). Box body shall have knock outs. Do not saw cut body. The minimum size box is as shown on Drawings. Increase box size as required to fit. Valve box lids are to indicate the controller letter and station number of valve as accepted by Owner’s Representative. Also refer herein to required polyurethane tag at valve solenoid control wire under Control Wires. Locate the identification in center of the lid. Provide separate box for each valve. Provide H/20 Loading

concrete boxes with bolt-down concrete lids for all valves that occur in paved areas.

2.13 DECODERS

A. Controller shall interface with decoders, each capable of controlling 1, 2, 4 or 6 remote control valves. Provide a sensor decoder for flow sensor(s) on two wire path.

B. Wire connections from decoder output to solenoid shall be 14AWG. Wire distance from decoder output to solenoid under normal conditions shall not exceed 150 feet. Install in valve box secured and with bottom of decoder facing up.

C. Contractor shall indicate associated valve numbers on manufacturer provided label on decoder with permanent marker.

2.14 CONTROL WIRE

A. 14AWG for two-wire cable path shall be twisted and jacketed Paige P7072D wire,or approved equal within Sch. 40 PVC 1.25 inch conduit. Coated wire shall not be accepted as an equal. Acceptable equal products must consist of two separately PE jacketed wire twisted inside of a PE jacket.

B. Contractor shall install 14AWG wire cable for wire path length up to 10,000 feet, and 12AWG wire cable for wire path length up to 15,000 feet.

C. Wire jacket colors shall be such to facilitate the identification of various wire path zones: provide chart for wire type, color and associated valves

D. The controller shall provide a minimum of three, two-wire paths per output module. Contractor shall not connect any two wire path from one output module to another output module.

E. Wire connection from decoder output to solenoid shall be colored to match the associated decoder output station color; red and blue colored wires shall not be used for connection between decoder output and solenoid.

2.15 WIRE SPLICES

A. Provide polyurethane tag at valve solenoid control wire that shows the controller number and station number. Also refer to valve box lid identification

B. All connections and splices in the red/blue two wire path must be made with 3M DBR/Y-6 waterproof connectors installed per manufacturer’s instructions in valve box with open end of connector facing down.

2.16 SWING JOINTS

A. Bubblers: Use Dura, Lasco, Rain Bird or equal pre-assembled swing joints with O-rings.

B. Quick Coupling Valve: Dura 1-inch 1-A2-1-11-18 pre-assembled swing joint with O-rings and Dura quick lock to receive stabilizing rod.

2.17 SHRUB & TREE BUBBLERS

A. As shown on drawings

2.18 IN-LINE DRIP IRRIGATION

A. As specified herein and as shown on the drawings and in accordance with manufacturer's recommendations. Provide all miscellaneous valves, filters fittings etc. required for a complete, operable system including the following:

1. Rain Bird XFD/XFS/XFCV with "Copper Shield" technology. Drip system in accordance with "RainBird Xerigation Low-Volume Landscape Irrigation Design Manual" and as shown on the drawings as required for a complete working system.
2. Toro DL 2000 Techline, in-line Treflon impregnated emitter with Netafim Automatic Flush Valves, Toro DL 2000 Air/Vacuum Relief Valves in accordance with "Toro DL-2000 Low-Volume Irrigation Bidding Specifications and Design Details" and as shown on the drawings as required for a complete working system.
3. Pop-up operation indicator
4. Air/vacuum relief valves
5. Flush valves

B. Drip Valve Assembly: Size valve box large enough and deep enough to contain assembly and allow convenient access and easy removal of filter screen. Position filter pointed down, approximately 45 degrees.

C. Pressure regulator: Size regulator in accordance with flow rate. Do not over size. Use factory pre-set regulator at 30 PSI.

D. Subsurface dripline tubing flush cap, and diffuser cap to be non-potable purple color.

2.19 Y-STRAINER

A. "Y"-Strainer upstream of remote control valves, Brass, 100 mesh.

2.20 RCV IDENTIFICATION TAGS:

A. Plastic or brass tags with valve number, approximately 2” by 2” with number imprinted, as accepted by Owner.

2.21 MISCELLANEOUS INSTALLATION MATERIALS

A. Solvent Cement and Primers for Solvent-weld Joints: Make and type approved by manufacturer(s) of pipe and fittings. Maintain cement proper consistency throughout use.

B. Pipe and Joint Compound: Permatex: Do not use on inlet port.

2.22 MISCELLANEOUS EQUIPMENT/ACCESSORIES

A. Sleeves and Conduits: See Drawings.

B. Key(s) for Quick-Coupling Valves:
1. Type: Same manufacturer as Quick-Coupling Valve.

2.30 OTHER EQUIPMENT: As shown on Drawings and required for a fully functional irrigation system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Sleeves and Conduits: Verify that all installed sleeving and conduits are undisturbed and are free of defects or errors introduced by the work of other sections.

B. Water Meter/Water Pressure: Test and verify that existing water pressure is the minimum pressure at maximum system g.p.m. to operate the irrigation system as indicated on the drawings.

C. Stub-outs: Verify that all stub-outs to be provided under another contract are correctly sized, located and installed as noted on Drawings.

D. Notification: Submit written notification to Owner's Representative within ten (10) working days of above inspections describing all acceptable and non-acceptable site conditions.

3.2 CONNECTIONS TO SERVICES

A. Provide and coordinate connection to water meter.

B. Provide and coordinate connection of irrigation controller to electrical power source.

3.3 INSTALLATION

A. Install irrigation system components in accordance with this Section, with the Drawings, with the manufacturer's recommendations, and with established industry standards. The Contractor shall do nothing that may jeopardize any manufacturer warranty.

B. Automatic Controller:
1. General: Install with lock box cutoff switch per local code and manufacturer's current printed specifications. Provide each controller with its own independent low voltage common ground wire.
2. Connection to Valves: Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.
3. Labeling: Affix controller letter (i.e., "A") on inside of controller cabinet door with minimum of one-inch (1") high permanent letter.
4. Irrigation Diagram: Affix a non-fading, waterproof copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two plastic sheets, 20 mil. minimum thickness. Use a legible reduced copy of the Record Drawing for the irrigation diagram clearly showing all valves operated by the controller, station, number, valve size, and type of planting irrigated. Color code area operated by each valve.

C. Control Wiring:
1. General: Install control two wire in Sch 40 PVC conduit in common trenches with sprinkler mains and laterals wherever possible. Lay to the bottom side of pipe line. Provide looped slack at valves.
2. Extra Length: Provide 36 inches (36") extra wire at each remote control valve splice to facilitate the removal of the remote control bonnet to finish grade without cutting wires.
3. All connections and splices in the red/blue two wire path must be made with 3M DBR/Y-6 waterproof connectors installed per manufacturer's instructions in valve box with open end of connector facing down.
4. Any splices in the two wire path not associated with a decoder shall be housed in separate valve boxes with 36 inches loop of slack wire.
5. Contractor shall indicate two wire path directions in permanent marker within 6 inches of two wire splice on wire jacket or conduit.
   a. Incoming wire shall be marked 'controller' on wire jacket or conduit.
   b. Each outgoing two wire path shall be maked with connected valves on wire jacket.
6. Contractor shall ensure all connections to be watertight with no electrical leakage to ground or shorting between conductors.
7. Detection Wire: Install a bare #12 copper wire or greater on top of the PVC supply line for the purpose of possible future mine detection search.

D. Grounding
1. All grounding and installation of equipment specified shall be installed in compliance with the manufacturer's recommendations and in accordance with local, state, and federal requirements.
2. Both the controller and the decoders shall be grounded to ground rods or plates with less than 10 OHMS resistance.

3. Irrigation controller and pad shall not fall within the sphere of influence of a ground rod or plate.
4. At a minimum earth ground shall be connected at the first decoder of each wire path leaving the controller, and every twelve valve/decoder or 1,000 feet of two wire run (whichever is shorter), and at the last valve/decoder in any wire run exceeding 50 feet from main wire path.

E. Rain Shutoff Switch:
1. Install switch in area not affected by irrigation or rain shadow. Provide wires in rigid conduit as accepted by Owner's Representative.

F. Excavating and Trenching:

1. Prior to trenching, layout main and lateral line locations within Drip Line of trees and review locations with Owner's Representative. Relocate any lines that may interfere with existing root systems to avoid or reduce damage to root systems as accepted by Owner's Representative.
2. Dig trenches wide enough to allow a minimum of three inches (3") between parallel pipe lines. Provide a minimum cover from finish grade as follows:
   a. 24-inches Deep: Over pipe on pressure side of irrigation control valve, control wires and quick-coupling valves.
   b. 36-inches Deep: Over all pipe and pipe sleeves under roadways, parking lots, entrance to parking lots and Fire-Access Lanes per NFPA 24, Section 10.4.4.
   c. 18-inches Deep: Over pipe on non-pressure side of irrigation control valve.
   d. Direct Burial PVC Piping Under Pavement: Provide a minimum of 4 inches of sand backfill on all sides and 24 inches cover to bottom of paving.

G. Conduits and Sleeves:
1. Coordination: Provide conduits and sleeves and coordinate installation with other trades.
2. Extent: Install sleeves where control wires in conduit and pipes pass under paving or through walls as shown on Drawings. Extend twelve inches (12") beyond edges of paving and walls and cap ends until ready for use.

H. Pipeline Assembly:
1. Install pipe and fittings in accordance with manufacturer's current printed Specifications.
2. Clean all pipes and fittings of dirt, scale and moisture before assembly.
3. Solvent-welded Joints for PVC Pipes:
   a. Solvents: Use solvents and methods specified by pipe manufacturer.
   b. Curing Period: Minimum of one (1) hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure.
4. Threaded Joints for Plastic Pipes:
   a. Use Permatex on all threaded PVC fittings except sprinkler heads and quick coupler valve ACME threads.
   b. Joining: Use strap-type friction wrench only. Do not use metal-jawed wrench. Assemble finger tight plus one or two turns.
5. Laying of Pipe:

a. Bedding On-grade: Remove from trench all rocks or clods. Bed pipe in at least 2 inches of soil excavated from trench. Backfill on all sides of piping to provide a uniform bearing.
b. Snaking: Snake pipe from side to side of trench bottom to allow for expansion and contraction. Minimum allowance for snaking is one (1) additional foot per 100 ft. of pipe.
c. Moisture Restrictions: Do not lay PVC pipe when there is water in the trench. Do not assemble PVC pipe unless the pipe is dry.

I. Closing of Pipe and Flushing of Lines:
1. Capping: Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.

J. Detection Wire and Warning Tape:
1. Install a bare # 12 copper wire or greater on top of the PVC supply line and over control wire conduit for the purpose of possible future mine detection search.

K. Control Valves:
1. Install in valve boxes where shown on Drawings and group together where practical. Install box flush with finish grade, not necessarily level. If valve occurs in drainage swale, relocate out of drainage swale as approved by Owner's Representative.
2. Where two or more valves are installed adjacent to each other, provide at least six inches (6") separation. Align boxes in a row, perpendicular with pavement edge.
3. Permanently mark valve box lid with 2" black valve number and controller letter or with numbered metal tag inside box as approved by Owner's Representative.
4. Refer to control wiring for required spare wire in each valve box.

L. Install “Y”-Strainer upstream of remote control valves at backflow preventer with two pressure gauges, one upstream and one downstream of each strainer/filter.

M. RCV Identification Tags:
1. Install in remote control valve box as recommended by manufacturer and as accepted by Owner’s Representative.

N. Bubblers:
a. Coordinate installation with planting contractor to insure timely and proper placement of heads at new planting.

O. In-Line Drip Irrigation

1. Coordinate plant locations with emitter locations. Refer to QUALITY ASSURANCE herein.
2. Coordinate hand watering of emitter irrigated and drip irrigated areas. Refer to QUALITY ASSURANCE herein.
3. Coordinate emitter spacing with planting types and plant spacing as accepted by Landscape Architect. Install emitters at uniform 18 inches on

center maximum and 2 to 4 inches deep, except where emitter spacing and depth is shown otherwise.

4. Adjust spacing on slopes to prevent over watering at base of slopes. Install system in accordance with manufacturer's recommendations and as shown on the Drawings as required for a complete working system.
5. Provide air/vacuum relief valves at all high points on systems.
6. Provide filter as shown and as recommended by emitter manufacturer.
7. Tape pipe ends during installation and do not allow dirt or debris to enter pipe.
8. Use emitter line with the specified emitter flow rate and emitter spacing. Assemble dripper line to allow water to flow continuously and directly, with no dead ends or dead end loops between control valve and flush valve.
9. Use fittings at sharp bends and do not allow dripper line to kink.
10. Install emitter line around perimeter of planter not more than 3 inches off edge for ground cover and turf, 18 inches maximum for shrub planting.
11. Adjust alternate rows so emitters are spaced in a triangular pattern.
12. Collect water from multiple dripper lines and convey the water to automatic line flush valve.
13. Install flush valve at end(s) of collector laterals so that entire system will flush and be free of dirt and debris.
14. Flush valves shall be open when water is turned on for the first time and after a break in the main or lateral lines. Extend collector lateral as required and locate flush valve at convenient accessible location.
15. Flush the systems weekly through the first month of the maintenance period.
16. Thoroughly saturate soil prior to planting. Provide additional surface watering as required to keep plant root systems moist during planting establishment period.

3.4 MISCELLANEOUS EQUIPMENT

A. Install miscellaneous equipment with concrete footings, brackets, etc., as required and as recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Testing of Irrigation System:
   1. Make hydrostatic tests with risers capped when welded PVC joints have cured at least 24 hours. Center load piping with backfill to prevent pipe from moving under pressure. Keep all couplings and fittings exposed.
   2. Install two (2) pressure gauges at opposite ends of main line system. Pump system up to a minimum of 125 psi the day preceding the scheduled test and verify that pressure is holding. Inspect system early following day and immediately notify Owner's Representative if the test confirmation must be postponed.
   3. Apply continuous static water pressure of 125 psi in accordance with Caltrans Standard Specifications Section 20-2, except after a drop in pressure (5 psi maximum), then the pressure must stabilize and remain stable for a one (1) hour minimum period before acceptance of the test.

4. Leaks detected during tests shall be repaired and test repeated until system passes tests at no additional cost to Owner.

B. Irrigation Audit Report with Certificate of Completion
   1. Per the requirements of the California Model Water Efficient Landscape Ordinance, the Contractor shall perform an irrigation audit and provide a report with certificate of completion to the local agency that may include, but is not limited to: inspection, system tune-up, system test with distribution uniformity, reporting overspray or run off that causes overland flow, and preparation of an irrigation schedule. Irrigation audits shall be conducted by a CLIA Certified landscape Irrigation Auditor by the Irrigation Association. Operation of the irrigation system outside the normal watering window is allowed for auditing and system maintenance.

C. Adjustment of the System:
   1. When the landscape irrigation system is completed and before planting, perform a coverage test in the presence of the Owner's Representative to determine if the water coverage for planting areas is adequate.
   2. Test controllers individually in the presence of the Owner's Representative and the Landscape Architect. Demonstrate that all control valves operate electronically. Provide vehicles and radio equipment as necessary to expedite this process.
   3. Demonstrate to Owner's Representative that irrigation scheduling programmed into controller is adequate for plant requirements without causing runoff, and that scheduling capacities of controller are utilized.

3.6 IRRIGATION SCHEDULING AND CONTROLLER PROGRAMMING

A. Per the requirements of the California Model Water Efficient Landscape Ordinance All irrigation schedules and programs shall be developed, managed and evaluated to utilize the minimum amount of water required to maintain plant health.

B. Irrigation controller Scheduling and Programming Parameters to be conducted by a CLCA Certified Irrigation manager and submitted to the local agency as part of the Certificate of Completion.

C. Parameters used to set the automatic controller shall be developed for each of the following:
   1. Plant establishment period
   2. Established landscape period
   3. Temporary irrigated area (if applicable)

D. Each irrigation schedule shall consider for each station all of the following that apply:
   1. Irrigation interval (days between irrigation)
   2. Irrigation run times (hours or minutes per irrigation event to avoid runoff
   3. Number of cycle starts required for each irrigation event to avoid runoff
   4. Amount of applied water scheduled to be applied on a monthly basis
   5. Application rate setting
   6. Root depth setting

7. Plant type setting
8. Soil type
9. Slope factor setting
10. Shade factor setting
11. Irrigation uniformity or efficiency setting

E. Total annual applied water shall be less than or equal to Maximum Applied Water Allowance (MAWA). Actual irrigation schedules shall be regulated by automatic irrigation controllers using current reference evapotranspiration data (CIMIS or soil moisture sensor data).

3.7 BACKFILL AND COMPACTING

A. General: After system is operating and required tests and reviews have been made, backfill excavations and trenches with clean soil, free of debris.

B. Backfill for All Trenches: Regardless of the type of pipe covered, compact to minimum 95% density under pavements and 85% under planted areas.

C. Finishing: Dress off areas to finish grades. Re-dress any areas which subsequently settle.

D. Owner's testing agency will test backfill compaction in areas under paving.

3.8 MAINTENANCE

A. The entire sprinkler irrigation system shall be under full automatic operation for a period of 2 days prior to any planting.

B. The Owner's Representative reserves the right to waive or shorten the operation period.

C. Maintain/repair system for full duration of plant maintenance period.

3.9 REVIEWS PRIOR TO ACCEPTANCE

A. Notify the Owner's Representative in advance for the following reviews, according to the time indicated:
1. Supply line pressure test and control wire installation - 72 hours.
2. Coverage and controller test - 72 hours.
3. Final review - 7 days.

B. No reviews will commence without record drawings, without completing previously noted corrections, or without preparing the system for review.

3.10 FINAL REVIEW AND CLEANUP

A. Operate each system in its entirety for the Owner's Representative at time of final review. Any items deemed not acceptable by the Owner's Representative shall be reworked to the complete satisfaction of the Owner's Representative.

B. Provide evidence to the Owner's Representative that the Owner has received all accessories and equipment as required before final review can occur.

C. Final acceptance and start of warranty period will occur no earlier than the end of the plant maintenance period.

D. For time of final review, Contractor shall arrange a meeting with the Owner's maintenance personnel to demonstrate the operation of the irrigation systems automatically in order to verify acceptance and to familiarize the maintenance personnel with the system and recommended programming.

END OF SECTION

SECTION 32 90 00

PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide planting work and planting maintenance complete as shown on the drawings and as specified including staking and layout of the landscaping, including soil sampling as required by the State of California Model Water Ordinance.

B. Related work specified elsewhere includes:

1. Section 31 10 01, PLANT PROTECTION
2. Section 31 00 00, EARTHWORK
3. Section 32 84 00, IRRIGATION

1.2 QUALITY ASSURANCE

A. Reference Standards:
1. All local, municipal and state laws, codes and regulations relating to all portions of this work are to be incorporated as part of these Specifications. These specifications shall not be construed to conflict with any of the above codes, regulations or requirements. The Specifications and Drawings shall take precedence when they call for materials, workmanship or construction of a better quality or higher standard than required by the above mentioned codes and regulations. Furnish without extra charge additional materials and labor required to comply with above rules and regulations.
2. State of California Model Water Ordinance
3. Bay Area Stormwater Management Agencies Association (BASMAA) Regional Biotreatment Soil Specifications.
4. Public utility agency having jurisdiction over the project work.
5. "American Standards for Nursery Stock," American Association of Nurseryman, 230 Southern Building, Washington, D.C. 20005.
6. International Society of Arboriculture, Guide for Plant Appraisal, latest version.
7. US Composting Council Compost Analysis Program (CAP)
8. US Composting Council (USCC) Seal of Testing Assurance (STA) program.
9. Test Methods for the Evaluation of Composting and Compost (TMECC)
10. Manufacturer's recommendations.

B. Qualifications:
1. Experience: Assign a full-time employee to the job as foreperson for the duration of the Contract who is certified landscape technician, certification through CLCA or minimum of five (5) years experience in landscape installation and maintenance supervision, with experience or training in entomology, pest control, soils, fertilizers and plant identification

2. Labor Force: Provide a landscape installation and maintenance force thoroughly familiar with, and trained in, the work necessary to complete the tasks described herein in a competent, efficient manner acceptable to the Owner.

C. Requirement
1. Site Visit: At beginning of work, visit and walk the site with the Owner's Representative to clarify scope of work and understand existing project/site conditions.
2. Supervision: The foreperson shall directly supervise the work force at all times and be present during the entire installation. Notify Owner's Representative of all changes in supervision.
3. Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and a labor force uniformly dressed in a manner satisfactory to Owner's Representative.
4. Protect all existing and new plants from construction activities, deer & rodents: Contractor shall be responsible for protection of all planting per Part 3.

D. Plant Material Standards:
1. Quality and Size of Plants: Conform to the State of California Grading Code of Nursery Stock, No. 1 grade. Use only nursery-grown stock which is free from insect pests and diseases.
2. Comply with federal and state laws requiring inspection for plant diseases and infestations, including Phytophthora. Submit inspection certificates required by law with each shipment of plants, and deliver certificates to the Owner. Obtain clearance from the County Agricultural Commissioner as required by law, before planting plants delivered from outside the County in which planted.

E. Soils & Amendment Testing
1. All soils & amendments to be tested for suitability by one of the following accredited soil testing laboratories (or approved equal). Components of the test shall include all major nutrients, pH, salinity, boron, sodium, micronutrients, copper, zinc, manganese and iron, adsorption rate, organic content and texture. The laboratory report shall include recommendations for adjusting fertilizer and amendment quantities.

Lucchesi Plant & Soil Consulting
Los Gatos, CA (408) 337-2575

Waypoint Analytical, Inc.
4741 E. Hunter Ave, Suite A, Anaheim, CA 92807; (717) 282-8777

Control Laboratories
42 Hangar Way, Watsonville, CA 95076; (831) 724-5422

Perry Laboratory
424 Airport Boulevard , Watsonville, CA 95076; (831) 722-7606

Wallace Laboratories, LLC
365 Coral Circle, El Segundo, CA 02345; (310) 615-0016

2. Upon approval of the laboratory's report by the Landscape Architect, the recommendations in the report shall become a part of the Specifications and the soil preparation procedures, quantities of soil amendment, fertilizer and other additives shall be adjusted to conform with the report at no additional cost to the owner. Note that there is a minimum quantity of organic amendment specified elsewhere in this specification section.
3. Significant issues with soil quality will require soil to be retested in the locations identified on Soil Analysis Plan, prior to proceeding with plant installation, to ensure that the recommendations in the report have been followed and the In-Situ Topsoil is horticulturally suitable as described in Part 2.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms. Subsoil is defined as either existing site soil located below the topsoil prior to construction activities, or select fill used for rough grading during construction. Subsoil cannot be considered for use as planting soil.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.

D. Planting Soil: Approved existing topsoil or imported planting soil, meeting the requirements herein. Subsoil cannot be considered for use as planting soil.

1.4 SUBMITTALS, per Section 01 30 00.

A. The following shall be submitted to the Landscape Architect for approval prior to the installation of landscape materials and products.
   1. Manufacturer’s Technical data sheets for fertilizers and all other products and materials listed herein.
   2. Manufacturer’s technical data sheets for amendments. Reports to be dated no more than 3 months prior to soil preparation.
   3. 1-pint samples of imported soils, organic amendments/compost, mulches, and cobbles.

B. Submit planting soil and organic amendment laboratory reports a minimum of 3 weeks prior to beginning soil prep. See below for required soil analysis reports.

C. Required Soil Analysis Reports. Reports to be dated no more than 3 months prior to soil preparation.

1. Soil Analysis Plan: Contractor to submit annotated plan showing confirmed locations of all required soil tests. Each location is to be identified with a unique label.
2. Existing Planting Soil Analysis: After approval of the Soil Analysis Plan, rough grading, and topsoil placement, contractor to obtain 3 representative samples of in situ topsoil taken from approved site locations at depth of 4" to 6" below finish grade and submit to an accredited soils testing laboratory for “horticultural suitability" analysis, including particle size, infiltration rate, and evaluation of physical and chemical properties of soil and recommendations for adding amendments and fertilizers to the soil.
3. Subsoil Analysis: In addition to the above required soil samples, contractor to obtain one representative sample of any subgrade soil that is to receive a layer of imported planting soil over it. The laboratory report shall include the soil’s infiltration rate, total combined silt and clay content for determining the total allowable combined silt and clay content of the imported planting soil specified herein.
4. Imported Planting Soil Analysis: Contractor to submit an " horticultural suitability" analysis report from an accredited soils testing laboratory, including particle size, infiltration rate, and evaluation of physical and chemical properties of soil and recommendations for adding amendments and fertilizers to the soil. Soil to conform to requirements in Part 2.
5. Amended Planting Soil Analysis: Significant issues with soil quality will require soil to be retested in the locations identified on Soil Analysis Plan, prior to proceeding with plant installation, to ensure that the recommendations in the report have been followed and the final Planting Soil is horticulturally suitable as described in Part 2.

D. The Contractor is responsible to follow all local water ordinances and make available to the local agency the soil analysis report and verification of its implementation as required.

E. Delivery Receipts upon request by Owner, provide delivery receipts for quantities of soil & amendments delivered to the site.

F. Representative photos of trees with measuring pole and plant species (unless trees or plants previously tagged at nursery by landscape architect). Identified and dated photos of trees and plants to be the trees and plants delivered to site and not a stock photograph.

G. Entire plant quantity delivered to the site. Plants to be reviewed prior to installation during a single site visit.

1.5 WARRANTY AND REPLACEMENT

A. Maintenance Period: See Part 3.

B. Warrant the work against weed growth for a period of four (4) months after application of Pre-Emergence Weed Killer.

C. Warrant all plants to be in a healthy, thriving condition until the end of the maintenance period, and deciduous trees, shrubs and vines beyond that time until active growth is evident.

D. Replace all dead and damaged plants and plants not in a vigorous condition immediately upon discovery and as directed by the Owner's Representative and at no cost to the owner. Install replacement plants before the final acceptance of the maintenance period in the size specified.

E. Warrant all products, prepared soils and plant material installed and maintained by contractor against defects for a period of one year after final acceptance of the maintenance period.

PART 2 - PRODUCTS

2.1 SUBSOIL

A. Submit soil analysis report from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

2.2 EXISTING PLANTING SOIL (ON-GRADE):

A. Existing Planting Soil is defined as on-site topsoil that is either to be removed and stockpiled for reuse or to remain in place during construction. Satisfactory planting soil shall be free of subsoil, clay, lumps, stones, and other objects over 4" in diameter, and without weeds, roots, and other objectionable material. The soil shall be fertile, friable, natural, productive soil containing a normal amount of humus, and shall be capable of sustaining healthy plant life. Soil shall not be infested with nematodes or with other noxious animal life or toxic substances. Soil shall be obtained from well-drained, arable land, and shall be of an even texture. Soil shall not be taken from areas on which are growing any noxious weeds such as morning glory, equisetum, or Bermuda grass, etc.

B. If herbicide contamination is suspected then a radish/ryegrass growth trial must be performed. Consult with Landscape Architect prior to decision to test or not.

C. Amended Planting Soils are to conform with the following target levels. Elements are expressed as mg/kg dry soil or mg/l for saturation extract.

pH value	6.5-7.9,	iron	4-15 mg/kg
lime	none present	manganese	0.6-3.0 mg/kg
salinity (ECe)	0.5-3 milli-mho/cm	zinc	1-3 mg/kg
chloride	<150 ppm	copper	0.2-3.0 mg/kg
nitrate	20-30 ppm	boron	0.2-0.5 mg/kg
SAR	<3	magnesium	25-100 mg/kg
phosphorus	8-20 mg/kg	sodium	<200 mg/kg
potassium	60-180 mg/kg	sulfur	25-100 mg/kg

D. If sufficient on-site surface topsoil is not available, contractor to provide imported planting soil as specified below. Placement of dissimilar soils shall be coordinated with irrigation zones by the contractor to maintain separate valves for dissimilar soils.

E. Submit soil analysis report from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

2.3 IMPORTED PLANTING SOIL (ON-GRADE):

A. Imported planting soil shall be screened and shall be free of subsoil, heavy or stiff clay, rocks, gravel, brush, roots, weeds, noxious seeds, sticks, trash, and other deleterious substances.

B. Imported Planting Soils are to conform with the following target levels. Elements are expressed as mg/kg dry soil or mg/l for saturation extract.

pH value	6.5-7.9,	iron	4-15 mg/kg
lime	none present	manganese	0.6-3.0 mg/kg
salinity (ECe)	0.5-3 milli-mho/cm	zinc	1-3 mg/kg
chloride	<150 ppm	copper	0.2-3.0 mg/kg
nitrate	20-30 ppm	boron	0.2-0.5 mg/kg
SAR	<3	magnesium	25-100 mg/kg
phosphorus	8-20 mg/kg	sodium	<200 mg/kg
potassium	60-180 mg/kg	sulfur	25-100 mg/kg

C. The silt and clay content of Imported Planting Soil shall not exceed that of the existing soil it is to be placed over. Except where otherwise required, it shall be a "Sandy Loam" as classified in accordance with USDA Standards with a combined total of between 25% to 40% Clay and Silt.

D. Submit soil analysis report from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

E. Following approval of the sample, provide a one-half cubic yard sample, which shall be stored at the site of work for comparison with sample and subsequent loads of soil. The comparison sample shall be protected by a cover until the

installation of all soil has been completed and accepted.

2.4 ORGANIC AMENDMENT FOR PLANTING SOILS (ON-GRADE):

A. Ground Redwood or Ground Fir Bark with the following properties:

Percent Passing	Sieve Designation	
100	9.51 mm	3/8"
50-60	6.35 mm	1/4"
20-40	4.76 mm	No. 4
0-20	2.38 mm	No. 8 8 mesh

Redwood Sawdust

Dry bulk density, lbs. per cu. yd.	260-280
Nitrogen stabilized - dry weight basis	0.4% minimum
Salinity (ECe):	4.0 maximum
Organic Content:	90% minimum
Reaction (pH):	4.0 minimum

Ground Fir and/or Pine Bark

Dry bulk density, lbs. per cu. yd.	350 minimum
Nitrogen stabilized - dry weight basis,	0.5% minimum
Salinity (ECe):	4.0 maximum
Organic Content:	90% minimum
Reaction (pH):	4.0 minimum

B. Submit sample, product's technical data sheet, and analysis report from an approved soils laboratory for approval by the Landscape Architect. The analysis report should include compliance to the specifications above and directions for product use.

2.5 COMPOSTED YARD WASTE AMENDMENT FOR PLANTING SOILS (ON-GRADE):

A. The above ORGANIC AMENDMENT FOR PLANTING SOILS (ON-GRADE) is the specified organic amendment material. Acceptance of Composted Yard Waste Amendment in lieu of the above specified amendment material will be considered if the in situ planting soil salinity and soil structure is favorable for the inclusion of recycled yard waste organic matter, as approved by the Landscape Architect.

B. Composted yard waste amendment will not be accepted for use in on-structure raised planters and pots.

C. The composted yard waste amendment shall be a mixture of feedstock materials including green material consisting of chipped, shredded, or ground vegetation and mixed food waste, or clean processed recycled wood products. Single source, biosolids (sewage waste) compost will not be acceptable.

D. The addition of the compost shall result in a final ECe of the amended soil of less than 4.0 dS/m @ 25 degrees C. as determined in a saturation extract. Use the

following table to determine the maximum allowable Ece (dS/m of saturation extract) of compost at desired use rate and allowable Ece increase.

DESIRED USE RATE		MAXIMUM ALLOWABLE Ece INCREASE FROM AMENDMENT		
Cu. Yds. Amendment Per 1000 Sq. Ft. for Incorporation to 6" depth	Volume percentage of amendment	1 dS/m	2 dS/m	3 dS/m
		Maximum ECe of Compost		
1	5	14	28	42
2	11	7	14	21
3	16	5	9.5	14
4	22	3.5	7	10.5
5	27	3	5.5	8.5
6	32	2.5	4.5	7

Example: Specification calls for 6 cu. Yrds. Compost per 1000 sq. ft. for incorporation to 6" depth, and site soil has an ECe of 2.0. In order to avoid exceeding ECe of 4 in final blend, compost ECe shall be less than 4.5 dS/m.

E. Composted Yard Waste Soil Amendment properties to conform to the following:
1. Gradation:

% Passing by weight	Sieve Designation	
90		1/2"
85-100	9.51 mm	3/8"
50-80	2.38 mm	No. 8
0-40	500 micron	No. 35

2. Organic Content: Minimum 50% based on dry weight and determined by ash method. Minimum 250 lbs. organic matter per cubic yard of compost.
3. Carbon to nitrogen ratio: Maximum 35:1 if material is claimed to be nitrogen stabilized.
4. pH: 5.5 – 8.0 as determined in saturated paste.
5. Soluble Salts: See D. above.
6. Moisture Content: 35-60%.
7. Contaminants: The compost shall be free of contaminants such as glass, metal and visible plastic. Heavy meals, fecal coliform and Salmonella shall not exceed levels outlined as acceptable in the California integrated waste management regulations.
8. Maturity: Physical characteristics suggestive of maturity include:

a. Color: Dark brown to black.
b. Acceptable Odor: None, soil-like, or musty.
c. Unacceptable Odor: Sour, ammonia or putrid.
d. Particle Characterization: Identifiable wood pieces are acceptable, but the balance of the material shall be soil-like without recognizable grass or leaves.

F. Submit sample, product's technical data sheet, and analysis report from an approved soils laboratory for approval by the Landscape Architect. The analysis

report should include compliance to the specifications above, directions for product use, and a list of ingredients. It is the Contractor's responsibility to secure test of the proposed composted yard waste amendment (2 quart sample) and submit to a Soils Laboratory for evaluation and recommendations. The composted yard waste amendment sample shall be a grab sample from the currently available material that has been tested within the last 30 days and shall include the composter's Compost Technical Data Sheet that includes lab analytical test results and directions for product use along with list of ingredients. Refer to Part 1 for soil testing requirements.

G. Based on the Soils Laboratory evaluation, the addition of composted yard waste amendment shall not be acceptable if it creates a leaching requirement.

2.6 PLANTS

A. Plant the variety, quantity and size indicated on drawings. The total quantities indicated on the drawings are considered approximate and furnished for convenience only. Contractor shall perform plant quantity calculations and provide all plants shown on the drawings.

B. Measure trees and shrubs with branches in normal position. Height and spread dimensions indicated refer to the main body of the plant, and not from branch tip to tip.

C. Take precautions to ensure that the plants will arrive at the site in proper condition for successful growth. Protect plants in transit from windburn and sunburn. Protect and maintain plants on site by proper storage and watering.

D. Install healthy, shapely and well rooted plants with no evidence of having been root-bound, restricted or deformed.

E. Tag plants of the type or name indicated and in accordance with the standard practice recommended by the American Association of Nurserymen.

F. Substitutions will not be permitted, except as follows:
   1. If proof is submitted to the Landscape Architect that any plant specified is not obtainable, a proposal will be considered for use of nearest equivalent size or variety with an equitable adjustment of contract price.
   2. Substantiate and submit proof of plant availability in writing to the Landscape Architect within 10 days after the effective date of Notice to Proceed.

G. Tree Form
   1. Trees shall have a symmetrical form as typical for the species/cultivar and growth form.
   2. Central Leader for Single Trunk Trees: Trees shall have a single, relatively straight central leader and tapered trunk, free of co-dominant stems and vigorous, upright branches that compete with the central leader. Preferably, the central leader should not have been headed; however, in cases where the original leader has been removed, an upright branch at least ½ the diameter of the original leader just below the pruning point shall be present.

3. Potential Main Branches: Branches shall be evenly distributed radially around and appropriately spaced vertically along the trunk, forming a generally symmetrical crown typical for the species.
4. Headed temporary branches should be distributed around and along the trunk as noted above and shall be no greater than 3/8" diameter, and no greater than ½ diameter of the trunk at point of attachment.

H. Tree Trunk
1. Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.
2. Trunk shall be free of wounds (except properly-made pruning cuts), sunburned areas, conks (fungal fruiting-bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.
3. Tree trunk diameter at 6" above the soil surface shall be within the diameter range shown for each container size below, except where shown otherwise:

Container	Trunk Diameter	Soil level from Container Top
5 gallon	0.5" to 0.75"	1.25 to 2"
15 gallon	0.75" to 1.0"	1.75 to 2.75"
24" Box	1.5" to 2. 5"	2.25 to 3"
36" Box	>2.5"	2.25 to 3"
60" Box	>2.5"	3-6"

4. Tree trunks shall be undamaged and uncut with all old abrasions and cuts completely callused over. Do not prune plants prior to delivery.

I. Tree Roots
1. Trunk root collar (root crown) and large roots shall be free of circling and/or kinked roots. Contractor may be required to remove soil near the root collar in order to verify that circling and/or kinked roots are not present.
2. The tree shall be well rooted in the container. When the trunk is lifted the trunk and root system shall move as one and the rootball shall remain intact.
3. The top-most roots or root collar shall be within 1" above or below the soil surface. The soil level in the container shall be within the limits shown in above table.
4. The rootball periphery shall be free of large circling and bottom-matted roots.
5. On grafted or budded trees, there shall be no suckers from the root stock.

2.7 FERTILIZERS

A. General Landscape Fertilizers
Commercial fertilizer, pelleted or granular form, conform to the requirements of Chapter 7, Article 2, of the Agricultural Code of the State of California for fertilizing materials as follows:

Type A:
6% Nitrogen, 20% Phosphorus Acid and 20% Potash, (6-20-20)

Type B:

21 gram planting tablets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Agriform or 10gm BestPacks packets 20% Nitrogen, 10% Phosphoric Acid and 5% Potash (20-10-5) available from Best Fertilizer Co.

Type C (Maintenance Fertilizer)
Complete fertilizer 21% Nitrogen, 7% Phosphoric Acid and 14% Potash (21-7-14).

If commercial fertilizer having the above analysis is not obtainable, other similar commercial fertilizer may be used providing it meets the approval of the Landscape Architect.

2.8 IRON OR FERROUS SULFATE: Dry form.

A. Essential 20% Ferrous (Iron) Sulfate. A soluble product that can be broadcast or incorporated. Analysis of 20% Iron, 18% Sulfur.

2.9 PERFORATED DRAIN PIPE

A. Polyvinyl Chloride (PVC) pipe and pipe fittings shall meet extra strength minimum of SDR-35 of the requirements of ASTM Specification D3034.

B. Perforated and non-perforated corrugated polyethylene pipe, 3- to 10-inch diameter, shall meet the requirements of ASTM D883 and ASTM F412, and shall conform to Section 68 of the Standard Specifications.

C. Corrugated polyethylene pipe fittings shall comply with all requirements of AASHTO M-252-85I for 3- to 10-inch diameter pipe. Couplings shall be split or snap-on type for perforated pipe and split couplings with gaskets for non-perforated pipe. Cutting pipe with integral couplings will not be allowed.

D. Corrugated polyethylene pipe and fittings manufactured by Advanced Drainage Systems, Inc., shall be considered the standard to determine compliance to this specification.

E. Inspection Tube Cap: Paint cap one coat chocolate-brown color using Flat, exterior grade latex paint as accepted by Owner's Representative.

2.10 FILTER FABRIC / PERMEABLE LANDSCAPE FABRIC

A. Polyester or polypropylene non-woven filter fabric with uniform fiber distribution by "Terra Bond" #1115, "Mirafi, Inc." #140N, or approved equal.

2.11 PERMEABLE DRAIN ROCK

A. Permeable drain rock used in subsurface drain installations to be Class 2 permeable material in conformance with Section 4-68 "Subsurface Drains" of the Caltrans Construction Manual; gradation to 3/4" maximum size. Submit Sample for approval.

2.12 ROOT BARRIER

A. UB 18-2 as manufactured by Deep Root Corporation (800) 458-7668, Root Solutions, Inc. (800) 554-0914, or equal. Install a minimum of 6 panels/12 linear feet centered on each tree, where tree is within 8 feet of sidewalk, paving, or utilities.

2.13 PRE-EMERGENCE WEED KILLER

A. Clean non-staining as recommended by a licensed pest control specialist.

2.14 TREE STAKES

A. Lodge pole pine logs, clean, smooth, un-treated.

B. Unless otherwise shown on drawings, provide two-inch (2") diameter by eight feet (8') long for trees less than 8' high and 1" caliper.

C. Unless otherwise shown on drawings, provide three-inch (3") diameter by eight to ten feet (8' - 10') long for trees greater than 8' high and 1" caliper.

2.15 TREE TIES

A. Unless otherwise shown on drawings, provide rubber strap, 24-inch minimum length without sharp edges adjacent to trunk, V.I.T. cinch-tie, Dublin, CA, (818)882-9530, or approved equal.

B. Black corded rubber tree ties w/ clips by greensleeves.com

C. Biodegradable VStrap webbing by Treestrap.

2.16 MULCH

A. Organic Mulch:
   1. Decorative Fir bark, dark in color;Medium 1/2-inch to 1-1/2-inch size.
   2. Walk-On Bark; Coarsely shredded White Fir, Red Fir or Pine bark.
   3. Forest floor bark mulch by American Soil and Stone
   4. Arbor mulch by American Soil and Stone

2.17 COBBLE RIVER ROCK

A. Smooth clean washed +/- 3 inch grey river cobbles, Lin Creek or for substitutions refer to section 01 25 00.

PART 3 - EXECUTION

3.1 PLANT PROTECTION AND REPLACEMENT

A. Inspect and protect all existing and new plants and trees against damage from construction activities, erosion, trespass, insects, rodents, deer, disease, etc. and provide proper safeguards, including trapping of rodent and applying protective sprays and fencing to discourage deer browsing. Maintain and keep all temporary barriers erected to prevent trespass.

B. Repair all damaged planted areas. Replace plants immediately upon discovery of damage or loss.

3.2 TOPSOIL STRIPPING AND STOCKPILING

A. Strip existing planting soil to whatever depths encountered in areas that may be compacted due to construction activities and in a manner to prevent intermingling with the underlying subsoil or other objectionable material. Topsoil stripping is limited to area outside “Drip Line” of existing trees to remain and areas indicated on drawings and as approved by the Owner's Representative.

B. Remove heavy growths of grass from areas before stripping.

C. Stockpile existing planting soil in storage piles in areas shown, or where designated by Owner. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.

D. If herbicide contamination is suspected then a radish/ryegrass growth trial must be performed. Consult with Landscape Architect prior to decision to test or not.

3.3 LIME TREATED SOIL

A. If site work includes Lime Treatment of the subsoil, the Contractor shall remove full depth of treated soil beyond 12” from structure(s) and replace with approved planting soil.

B. Following removal of lime treated material, scarify subgrade to a minimum depth of 6 inches and test for drainage.

C. Test subgrade in all planting areas for drainage by flooding with minimum 4-inch depth of water puddle and verify complete absorption of standing water within two hours. If standing water is still present after two hours, provide perforated pipe and drain rock "French Drain" system in bottom of non-draining planters and connect to storm drainage system, as accepted by Owner's Representative prior to backfilling with approved planting soil.

3.4 GENERAL PREPARATION OF PLANTING SOIL

A. Submit soil analysis report of amended soils from an approved soils laboratory for approval by the Landscape Architect. Refer to Part 1 for soil testing requirements.

B. All planting soils to be amended as specified in soil laboratory analysis report(s).

C. Provide a minimum of 12” depth of amended planting soil in all planting areas, or more where shown or specified otherwise. Install soil in maximum 12” lifts. Compact each lift prior to installing subsequent lifts.

D. Thoroughly wet down the planting areas to settle the soil and confirm irrigation coverage and operation. Allow soil to dry so as to be workable as described herein.

E. After the rototill work, float areas to a smooth, uniform grade as indicated on the drawings. Slope all planting areas to drain. Roll, scarify, rake and level as necessary to obtain true, even planting surfaces. Remove rocks, sticks and debris 2 inches or larger in shrub and ground cover areas. Secure approval of the grade by the Landscape Architect before any planting.

F. Prior to planting, soil shall be loose and friable to a minimum depth of 12” with a relative maximum compaction of 85%. Rip and scarify any overly compacted and re-compacted planting areas (in two directions full depth of compacted soil) prior to planting.

G. Water settling, puddling, and jetting of soil and backfill materials as a compaction method is not acceptable.

H. Prior to planting, soil shall be moist, but not so moist that it sticks to a hand shovel. Do not work planting soil in a wet or muddy condition or dump or spread in areas where subgrade is not in proper condition.

I. Provide planting soil as a final lift in all planting areas within and adjacent to paved areas and other construction where native site soil has been covered by engineered fill and/or base rock. Unless otherwise shown or specified, finish grade in planting islands shall be crowned with a minimum 2% pitch to drain.

J. Finish Grade: Hold finish grade and/or mulch surface in planting areas1/2-inch below adjacent pavement surfaces, tops of curbs, manholes, etc. The subgrade of the mulch in mulched planting areas shall be a minus 2 inches at a distance of 12 to 18 inch from the edge of pavement. Drag finish grade to a smooth, even surface. Grade to form all swales and berms. Pitch grade with uniform slope to catch basins, streets, curb, etc., to ensure uniform surface drainage. Areas requiring grading include adjacent transition areas that shall be uniformly sloped between finish elevations. Slope surface away from walls so water will not stand against walls or buildings. Control surface water to avoid damage to adjoining properties or to finished work on the site. Take required remedial measures to prevent erosion of freshly graded areas.

K. Planting operations shall be performed only during periods when beneficial results can be obtained. When excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped until conditions are satisfactory.

3.5 PREPARATION OF IN-SITU PLANTING SOIL

A. In-Situ Planting Soil is defined as top soil left in its original place and undisturbed during construction activities which is to receive new planting

B. Except within tree driplines, rip all planting areas in two directions full depth to a minimum of 12“ into undisturbed native subsoil prior to amending. Scarification of any planting area which cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the Owner’s Representative to the specified depth to ensure proper percolation/drainage.

C. Inspect planting areas and remove all base rock and other foreign material. Verify placement of planting soil within dripline of trees with Owner's Representative.

D. Test depth of loose soil with hand shovel in presence of Owner’s Representative in several locations as directed.

E. After acceptance of the planting condition, uniformly mix and amend soil with required fertilizers, nutrients, etc. per specifications herein and recommendations given in soils reports.

F. In the case of a contradiction between the quantity of organic amendment required by the soils laboratory analysis and the specified quantity below, the greater of the two quantities shall take precedence. Spread organic amendment, iron and Type A fertilizer evenly over installed and rough graded on-site topsoil in all planting areas including ground cover and shrub areas at the following rates:
   1. Organic Amendment: 6 cubic yards per 1,000 square feet
   2. Fertilizer: Type A (6-20-20) at 20 lbs. per 1,000 square feet.
   3. Iron Sulfate: 10 lbs. per 1,000 square feet

G. Rototill above additives into soil 12” inches deep. Keep iron sulfate off pavement and other surfaces to prevent rust staining. Correct all rust damage to work.

H. Final planting soil shall have a pH range of 6.5 to 7.5.

3.6 PREPARATION OF IMPORTED PLANTING SOIL (ON-GRADE)

A. Uniformly distribute and spread Subsoil or select fill in planting areas to achieve rough grading and compact to a maximum of 85% relative compaction.

B. Except within tree driplines, rip all planting areas in two directions full depth to a minimum of 12“ into undisturbed native subsoil prior to backfilling. Scarification of any planting area which cannot be accomplished with a tractor shall be accomplished by an alternative method approved by the Owner’s Representative to the specified depth to ensure proper percolation/drainage.

C. Thoroughly water-settle subsoil to required subgrade prior to installing Top Soil.

D. Prior to placing planting soil secure the Owner's Representatives acceptance of the planting areas subgrade condition. Test depth of loose soil with hand shovel in presence of Owner's Representative in several locations as directed.

E. After acceptance of the planting areas subgrade condition, uniformly distribute and spread planting soil backfill over scarified subgrade in planting areas as specified.

F. Mix and amend soil with required fertilizers, nutrients, etc. per specifications herein and recommendations given in soils reports.

3.7 PRE-EMERGENCE WEED KILLER

A. Work shall be done under the supervision of a person licensed by the State of California as a pest control applicator and holding a qualified applicator license or a Qualified Applicator Certificate.

B. Apply pre-emergence weed killer in all areas to receive ground cover planting. Obtain approval of the finish grades prior to applying weed killer and coordinate planting and watering with the pest control specialist prior to planting. Take care to keep weed killer off areas to be seeded.

3.8 ROOT BARRIER

A. Install in continuous sheet parallel and adjacent to curb or pavement edge as required on drawings and in accordance with manufacturer's recommendations. Set top of barrier approximately ½-inch above finished soil surface to allow concealment with mulch, as accepted by Owner's Representative

3.9 TREE AND SHRUB PLANTING

A. Mark tree and shrub locations on site using stakes, gypsum or similar approved means and secure location approval by the Landscape Architect before plant holes are dug. Adjust location as required prior to planting.

B. Review location of plants in relationship to irrigation heads and adjust location(s) that interfere with the function of the spray heads. Adjust locations as required to ensure that the plant roots receive the proper amount of water in order for the plants to thrive.

C. Excavate tree, shrub and vine pits as follows:

	Width	Depth	
Boxed Trees	Box + 24"	Box depth	
Canned Trees (15 gc)	Can + 18"	Can depth	
Canned Shrubs/Vines (1- 5 gc)		Can + 12"	Can depth

D. Test drainage of plant beds and tree pits by filling with water (minimum 6"). The retention of water in planting beds and plant pits for more than two (2) hours shall be brought to the attention of the Landscape Architect. If rock, underground

construction work, tree roots, poor drainage, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by Landscape Architect.

E. Break and loosen the sides and bottom of tree pits to ensure root penetration and water test hole for drainage as required above.

F. Excavate plant hole or tree pit keeping excavated planting soil layer on the surface when backfilling around the plant. Carefully set plants as detailed without damaging the rootball. Superficially cut edge roots vertically on three sides. Remove bottom of plant boxes before planting. Remove sides of boxes after positioning the plant and partially backfilling.

G. Set plants in backfill with top of the rootball 1 inch above finished grade of adjacent soil. Backfill remainder of hole and soak thoroughly by jetting with a hose and pipe section. Water backfill until saturated the full depth of the hole.

H. Backfill plant holes with mix as specified, free from rocks, clods or lumpy material. Backfill native soil free of soil amendments under rootball and foot tamp to prevent settlement. Backfill remainder of the hole with soil mix and place plant tablets or packets (Type B fertilizer) 3 inches below finish grade and 1/2-inch from roots at the following rates:

1 gallon can plant	-	1 tablet or packet
5 gallon can plant	-	3 tablets or packet
15 gallon can plant	-	6 tablets or packet
24-inch box plant	-	6 tablets or packet
36-inch box plant	-	8 tablets or packet

I. Except for acid loving plants (Azaleas, Rhododendrons, Ferns, Camellias, etc.), use a soil mix of 2 parts soil from the hole, and 1 part amendment with iron added at the following rates:

1 gallon can plants	-	iron, 1/4 cup
5 gallon can plants	-	iron, 1/3 cup
15 gallon can plants	-	iron, 1/2 cup
24" box and larger	-	iron, 1 cup

Mix the iron, amendment and soil thoroughly for use in the top 8 inches of backfill around plants. For acid loving plants, mixture to be 1/2 soil from the hole and 1/2 amendment.

J. Remove any soil from top of plant rootballs and secure Landscape Architect's approval of rootball height prior to mulching.

K. After approval of rootball height, install mulch as required below.

L. Stake and/or guy trees as detailed. Drive stake(s) until solid (at least 12" beyond bottom of rootball) and remove excess stake protruding above top tree tie to prevent rubbing against branches. Avoid driving stakes through rootball. If subgrade does not accept stakes to a stable degree, delete stakes and guy the

trees as specified herein and as detailed. Locate tree ties to avoid contact with tree branches. Locate top tie at tree flex point.

M. Build watering basin berms around trees and shrubs to drain through rootball. Water backfill until saturated the full depth of the hole.

3.10 GROUND COVER PLANTING

A. Plant in neat, straight, parallel and staggered rows as indicated on plan. Plant first row one-half required ground cover spacing behind adjacent curbs, structures, or other plant bed limits. Plant ground cover to edge of water basins of adjacent trees and shrubs.

3.11 MULCH

A. Mulch all tree, shrub and ground cover areas with organic mulch to a 3-inch depth, except mulch to 2-inch depth where planting with ground cover plants from flats.

B. Hold bark mulch away from base (trunk) of plant 4" or as directed by the Landscape Architect.

C. Individual trees and/or shrubs planted in non-irrigated areas shall, at minimum, receive bark mulch over their watering basin and berm.

3.12 WATERING

A. Water all trees, shrubs and ground cover immediately after planting. Apply water to all plants as often and in sufficient amount as conditions may require to keep the plants in a healthy vigorous growing condition until completion of the Contract. Provide supplemental hand watering of trees and shrubs, as required, to maintain a moist root zones throughout plant establishment period.

3.13 PRE-MAINTENANCE PERIOD REVIEW AND APPROVAL OF PLANTING

A. Maintain plants from time of delivery to site until final acceptance of landscape installation.

B. Receive approval of the installed planting prior to commencement of planting establishment maintenance period. Notify the Landscape Architect or Owner’s Representative a minimum of seven (7) days prior to requested review. Before the review, complete the following:
   1. Complete all construction work.
   2. Present all planted areas neat and clean with all weeds removed and all plants installed and appearing healthy.
   3. Plumb all trees and tree and shrub supports.
   4. No partial approvals will be given.

3.14 PLANTING ESTABLISHMENT MAINTENANCE

A. General Requirements

1. **Maintenance Period:** The planting establishment maintenance period required shall be**90 calendar days** after all planting and irrigation is complete, and as approved by Owner's representative. A longer period may be required if the plant material is not acceptably maintained during the maintenance period. The start of the maintenance period to be confirmed by Owner's representative. Contractor to notify landscape architect of start and end dates of maintenance period. The maintenance period may be suspended at any time upon written notice to the Contractor that the landscaping is not being acceptably maintained, and the day count suspended until the landscape is brought up to acceptable standards as determined by the Owner Representative.
2. Planting establishment maintenance immediately follows, coincides with, and is continuous with the planting operations, and after all planting is complete and accepted; or longer where necessary to establish acceptable stands of thriving plants.
3. Protect all areas against damage, including erosion, trespass, insects, rodents, disease, etc. and provide proper safeguards. Maintain and keep all temporary barriers erected to prevent trespass.
4. Keep all walks and paved areas clean. Keep the site clear of debris resulting from construction or maintenance activities.
5. Repair all damaged planted areas, and replace plants immediately upon discovery of damage or loss.
6. Check irrigation system at each watering; adjust coverage and clean heads immediately. Adjust timing of controller to prevent flooding.
7. Maintain adequate moisture depth in soil to ensure vigorous growth. Check rootball of trees and shrubs independent of surrounding soils and hand water as required.
8. Keep contract areas free from weeds by cultivating, hoeing or hand pulling. Use of chemical weed killers will not relieve the Contractor of the responsibility of keeping areas free of weeds at all times.

B. Tree and Plant Maintenance
1. Maintain during the entire establishment period by regular watering, cultivating, weeding, repair of stakes and ties, and spraying for insect pests. Prune when requested by the Landscape Architect.
2. Keep watering basins in good condition and weed-free at all times.
3. Replace all damaged, unhealthy or dead trees, shrubs, and ground covers with new stock immediately; size as indicated on the drawings.

C. Fertilizing:
1. Upon approval and after submitting fertilizer delivery tags, maintenance fertilization shall begin 30 days after planting is complete. Fertilize all ground cover areas by broad-casting Type C (21-7-14) fertilizer at the rate of 5 lbs. per 1,000 square feet evenly throughout. Reapply every forty-five (45) days until acceptable.
2. Early spring and fall substitute a complete fertilizer such as 15-15-15 applied at the rate of 6 lbs. per 1,000 square feet, to help insure continuing adequate phosphorus and potassium.
3. Observe plant's color, and if a soil pH imbalance is suspected, take soil samples and obtain laboratory analysis for confirmation. Take necessary

action recommended in laboratory analysis such as top dressing with soil sulfur, leaching soil, etc.

3.15 FINAL PLANTING REVIEW AND ACCEPTANCE

A. At the conclusion of the Maintenance Period, schedule a final review with the Owner, the Owner's maintenance person, and/or the Landscape Architect. On such date, all project improvements and all corrective work shall have been completed. If all project improvements and corrective work are not completed, continue the planting establishment maintenance period at no additional cost to the Owner until all work has been completed. This condition will be waived by the Owner under such circumstances wherein the Owner has granted an extension of time to permit the completion of a particular portion of the work beyond the time of completion set forth in the Agreement.

B. Submit written notice requesting review at least 10 days before the anticipated review.

C. Prior to review, weed and restore all planted areas, plumb trees and tree supports, clear the site of all debris and present in a neat, orderly manner.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION 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 the following:

1. Locate and verify pipe size at water system connections.

2. Provide and install water system pressure pipe, fittings, and appurtenances.

3. Connect new water system to existing service lines.

4. Disinfection and testing of new water lines.

5. Notify City of Napa public works 2 weeks prior to any proposed construction on the public water line on the southwest side of the campus. The college shall pay for all water connection fees to the public water line prior to beginning any work on the public water line.

B. Related Sections include the following:

1. Trenching, Backfilling and Compaction – Section 31 23 16.

1.3 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Requirements:

1. Submit choice of pipe, fittings, thrust block concrete mix, and appurtenances for review prior to ordering.
2. Submit pothole information (location, pipe size, invert elevation, pipe material, etc) at all points of connection to existing water system before contractor orders any storm drain material or any water pipes are installed.

1.4 REFERENCES

A. California Plumbing Code (CPC), latest edition.

B. California Fire Code (CFC), latest edition.

C. National Fire Protection Association Standard for the Installation of Private Fire Service Mains and Their Appurtenances (NFPA 24), latest edition.

D. City of Napa Standard Requirements and Details.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Water pipe shall be delivered, handled, and stored in a way that prevents damage to the pipe, or the entry of foreign materials into the pipe.

B. Regardless of cause, damaged pipe shall be replaced with new products at the expense of the Contractor.

PART 2 - PRODUCTS

2.1 WATER PIPE AND FITTINGS

A. All private underground piping 4” in diameter and larger shall be AWWA C-900, DR 14 Class 305 psi PVC, or AWWA C151 ductile iron, minimum Class 300 cement lined pipe. All water main within the public right of way 4” diameter and larger shall be AWWA C-900, DR 18 Class 235 psi PVC.

B. Fittings and specials for pipe 4” diameter and larger shall be ductile iron, 350 psi working pressure. Materials and wall thickness shall be in accordance with AWWA C110 and ANSI/AWWA C111 for 350 psi working pressure. Fittings shall be by the same manufacturer as the pipe or as recommended by the pipe manufacturer.

C. All above ground fire main piping shall be AWWA C151 ductile iron, minimum Class 300 cement lined pipe.

D. All water pipe smaller than 4” in diameter shall be Polyethylene (PE) Class 200 or PVC, schedule 40. Pipe and jointing shall be compatible with the type of pipe and meet the respective requirements of AWWA. Polyethylene tubing shall be bedded in sand.

E. All water improvements to the City of Napa public water line shall meet City of Napa standards.

2.2 WATER SYSTEM APPURTENANCES

A. All public water system appurtenances, including but not limited to gate valves, water meters, backflow preventers, check valves and Fire Department Connections shall conform to the requirements of the City of Napa Standards.

B. Gate valves 4” diameter and larger: UL listed, or FM approved AWWA type C509 iron body, non-indicating, resilient wedge or resilient seat, non-rising stem gate valves, suitable for 250 psi minimum working pressure as manufactured by Clow, Muller, American Darling or Waterous.

C. Tie rods, clamps, and bolts shall be stainless steel. Tie rods and thrust blocks shall be used at risers; retaining glands are not acceptable.

D. Valve boxes: All underground valves shall be installed with valve boxes and risers as required. Valve boxes shall be Christy G5 with cast iron traffic lid in pavement areas and concrete lid in sidewalk or planter areas: risers shall be 8 inch minimum PVC pipe.

E. All valves 2" and smaller shall be bronze body ball valves centered in a valve box. All valves larger than 2" shall be gate valves.

F. Tracer Wire: A No. 10 copper wire shall be laid on top of and along the entire length of all exterior non-metallic pipes and shall be extended to the surface at each end of the pipe so locator equipment can be connected. Fasten the wire to the top of the pipe to prevent displacement during backfilling.

G. Bedding and Back fill: All bedding and back fill material shall comply with the minimum requirements of the City of Napa and NFPA 24, and as described in Section 31 2316.

H. Fire hydrants shall be per City of Napa standards and meet the requirements of the City of Napa fire department.

I. Thrust blocks: Concrete shall conform to the requirements in the detail in the construction drawings. Trust block concrete must have a minimum 28 day compressive strength of at least 2,500psi.

J. Protective coating: All protective coating shall be a coal tar based paint system consisting of a prime coat of Kop-Coat Bitumastic 50 and a second coat of Bitumastic 50, or approved equivalent. Plastic sheeting, (minimum 4 mil) may be used to wrap metal fittings.

K. Warning Tape: Provide polyethylene plastic warning tape, heavy gauge, minimum 6" wide, labeled "CAUTION-BURIED FIRE MAIN BELOW"; color: red; installed approximately 12" above pipe during back fill.

L. Restrained Joint Fittings: Shall be ductile iron in accordance with the applicable requirements of ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest revision, shall be UL and FM approved and shall be compatible with the type and pressure class of pipe used.

PART 3 - EXECUTION

3.1 GENERAL

A. All construction of the public water system shown on the plans shall conform to the requirements of the City of Napa Standards.

B. Construction of the private water system shall conform to the requirements of the CPC.

C. Construction of the private fire main shall conform to the requirements of the CFC and NFPA 24.

3.2 POTHOLING AT CONNECTION POINTS

A. The exact location and size of existing water service lines is unknown and is depicted on the plans based upon the best information available.

B. The Contractor shall pothole in the vicinity of each connection point to verify the exact location and size of the existing water line. That information shall be presented in the form of a field sketch through the RFI process, for confirmation by the engineer that the line as located is adequate to serve the proposed buildings.

3.3 PIPE DISTRIBUTION AND HANDLING

A. Acceptable shut down times are typically Saturday through Sunday and must be specifically approved in advance by the owner. Contact City of Napa Fire Department prior to any shut down of the colleges water system. Contractor shall work with the college and City of Napa Fire Department to determine acceptable times to shut down the college.

3.4 PIPE DISTRIBUTION AND HANDLING

A. Pipe distribution shall not take place too far in advance of laying operations.

B. Pipe shall be handled carefully to avoid damage. Pipe handling by mechanical equipment shall be in accordance with the pipe manufacturer's recommendations.

C. The spigot ends of pipes and fittings that utilize polyvinyl chloride or polyurethane factory applied flexible compression joints shall not rest on the ground or pavement.

D. All pipe, fittings and valves shall be carefully lowered into the trench by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to pipe materials, protective coatings and linings. Under no circumstances shall pipe materials be dropped or dumped into the trench.

3.5 INSTALLATION

A. All pipe, fittings, and appurtenances shall be installed as recommended by the manufacturer and conform to the requirements and standards of the City of Napa Fire Department and the City of Napa and NFPA 24.

B. Nominal cover over new supply pipe shall be a minimum of 36” from top of pipe to grade for pipes 3” diameter and larger and 30” for all other pipes unless indicated otherwise on the Construction Drawings.

C. Special attention shall be given during pipe laying to keep the pipe clean.

D. Thrust Blocking

1. Plugs, caps, tees, and bends, either vertically or horizontally on all water lines 3 inches in diameter and larger, except threaded fitting, shall be provided with thrust blocking, or metal tie rods and clamps, in accordance with AWWA C600 or as required by NFPA 24 and City Standards.

2. Thrust blocking shall be placed between solid ground and the fittings to be anchored with the base and effective thrust bearing side of the thrust block poured against undisturbed earth. The sides of the thrust blocks not subject to thrust may be poured against forms.

3. Tie rods, in addition to thrust blocks, shall be used at the riser where pipe enters the building.

4. Thrust blocks shall be poured so that fitting joints will be accessible for repair.

E. Install warning tape and tracer wire above all underground fire protection yard piping.

F. The fire hydrant shall be installed in accordance with City of Napa Fire Department and the City of Napa Standards. Fire hydrant color shall match City of Napa Fire Department standards.

G. Where pipes end temporarily without final connections, provide a 2” PVC marker pipe vertically from the bottom of the trench to 24” above grade.

H. The Reduced pressure backflow Detector Assembly shall be installed in accordance with the manufacturer’s instruction and City of Napa Standards.

3.6 PIPE LAYING

A. No pipe shall be laid in water or when trench conditions are unsuitable to allow performing the job in a workman-like manner.

B. Pipe shall be laid with bell ends facing in the direction of laying, and shall progress uphill.

C. Pipe deflections where permitted shall not exceed that recommended by the pipe manufacturer.

D. Pipe and fittings which do not allow sufficient space for joints shall be removed and replaced with pipe and fittings of proper dimensions.

E. Every precaution shall be taken to prevent foreign material from entering the pipe. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. If foreign materials do enter the pipe, they shall be removed continuously as work progresses.

F. At times when pipe laying is not in progress, the open ends of laid pipe shall be closed by a watertight plug.

G. Wherever the jointing material specified is cement, two or more lengths of pipe shall be in place ahead of each joint before such joint is finished.

3.7 FLUSHING AND TESTING

A. Public Water System

1. The public water main shall be flushed, chlorinated and tested in accordance with the City of Napa Standards

B. Private Potable Water System

1. The system shall be flushed with potable water until only potable water appears at the outlet point.

2. The system shall be disinfected in accordance with Section 609.9 of the CPC.

3. The system shall be hydrostatically tested in accordance with Section 609.4 of the CPC.

C. The private fire mains shall be flushed and tested in accordance with NFPA 24.

1. Pipes shall be flushed at the design flow rate of the system or at a rate which produces a velocity in the pipe of 10 feet per second, whichever is greater.

2. The systems shall be hydrostatically tested at not less than 200 psi for two hours. Leakage at the joints shall not exceed two quarts per hour per 100 gaskets or joints.

D. Tests shall be made by the Contractor in the presence of the authority having jurisdiction and the Owner’s Representative.

3.8 CONNECTIONS TO EXISTING SERVICES AND MAINS

A. Contractor shall make connections to existing mains where indicated on the plans. Said connections shall be made after new water pipe is flushed and tested in accordance with this specification. The Owner's Representative and City of Napa Inspector shall observe all tests.

B. Repair existing pavements as noted on plans.

3.9 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

END OF SECTION

SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pothole and locate and verify invert elevation of existing pipe at proposed point of connections.

B. Provide and install gravity sewer pipe.

C. Provide and install sewer cleanouts.

1.2 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Trenching, Backfilling and Compaction - Section 31 23 16.

2. Site Preparation – Section 31 10 00.

1.3 SUBMITTALS

A. In accordance with section 01 3300, Submittal Requirements:

1. Submit choice of pipe and appurtenances for review prior to ordering.

2. Submit choice of sanitary sewer pipe for review prior to ordering.

3. Submit pothole information (location, pipe size, invert elevation, pipe material, etc.) at all points of connection to existing site sewer system before Contractor orders any sewer material or any sewer pipes are installed.

1.4 REFERENCES

A. California Plumbing Code (CPC), latest edition.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Sewer pipe and sleeve shall be delivered, handled, and stored in a way that prevents damage to the pipe and the entry of foreign materials into the pipe.

B. Regardless of cause, damaged pipe shall be replaced with new products at the expense of the Contractor.

1.6 GRADE AND ALIGNMENT CONTROL

A. General

1. The necessary installation procedures that will ensure the pipes are installed at the location and grade staked in the field shall be used.

B. Method

1. One of the following methods shall be utilized to control grade and alignment:

a. Batter boards set at 25' intervals with a string line set over at least three batter boards.
b. Electronic "Laser" beam set at manhole locations or grade breaks. At least three grade points shall be checked to verify the set grade.
c. Survey instrument set at cleanout to site between cleanouts at the set grade.

C. Equipment

1. The Contractor shall furnish all equipment necessary to install and inspect the pipe installation. Grade rod shall be held to a minimum in all cases.

PART 2 - PRODUCTS

2.1 GRAVITY SEWER PIPE AND SERVICE LATERALS

A. Sewer pipe 4 inches in diameter and smaller shall be PVC, SDR 35 with gasketed joints.

2.2 CLEANOUTS

A. As shown and detailed on the Drawings.

B. Cleanout lids shall be concrete, marked "sewer".

PART 3 - EXECUTION

3.1 GENERAL

A. Construction of the private sewer system shall conform to the requirements of the CPC.

3.2 VERIFY EXISTING CONDITIONS

A. The exact location and depth of existing sewer line is unknown and is shown based upon the best information available.

B. Contractor shall pothole in the vicinity of each connection point to verify the exact location and size of the existing sewer line. This information shall be presented in

the form of a field sketch through the RFI process for review and confirmation by the Engineer that the line is adequate to serve the proposed project.

3.3 PIPE DISTRIBUTION AND HANDLING

A. Pipe distribution shall not take place too far in advance of laying operations.

B. Pipe shall be handled carefully to avoid damage. Pipe handling by mechanical equipment shall be in accordance with the pipe manufacturer's recommendations.

C. All pipe, fittings and valves shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe materials, protective coatings, and linings. Under no circumstances shall pipe materials be dropped or dumped into the trench.

3.4 PIPE LAYING

A. No pipe shall be laid in water or when trench conditions are unsuitable to allow performing the job in a workman-like manner.

B. Pipe shall be laid with bell ends facing in the direction of laying, and shall progress uphill.

C. Pipe deflections where permitted shall not exceed that recommended by the pipe manufacturer.

D. Pipe and fittings which do not allow sufficient space for joints shall be removed and replaced with pipe and fittings of proper dimensions.

E. Every precaution shall be taken to prevent foreign material from entering the pipe. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. If foreign materials do enter the pipe, they shall be removed continuously as work progresses.

F. At times when pipe laying is not in progress, the open ends of laid pipe shall be closed by a watertight plug.

G. Wherever the jointing material specified is cement, two or more lengths of pipe shall be in place ahead of each joint before such joint is finished.

H. Sanitary Sewer installation shall adhere to the requirements of CPC standards and specifications and the details on the plans.

3.5 TESTING

A. All new sewer lines and laterals shall be tested in accordance with procedures specified by the California Plumbing Code. The tests shall be observed by the Inspector On Record..

3.6 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

END OF SECTION

SECTION 33 40 00

SITE DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide and install storm, subdrain and roof drain pipe and appurtenances.

B. Provide and install storm and roof drain system structures, including clean-outs, drainage inlets, catch basins, etc.

C. Provide and install storm infiltration chambers and appurtenances, including separation fabric.

1.2 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Trenching, Backfilling and Compaction - Section 31 23 16.

1.3 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Requirements:

1. Submit choice of storm drain, subdrain and roof drain pipe and cleanouts, drainage structures, and drainage grates to Engineer for review prior to ordering.

2. Submit choice of storm infiltration chambers and appurtenances, including separation fabric, to Engineer for review prior to ordering.

1.4 REFERENCES

A. City Napa Design and Construction Standards, latest edition.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storm drain, subdrain and roof drain pipe, infiltration chambers, and drainage structures shall be delivered, handled, and stored in a way that prevents damage to the pipe, or the entry of foreign materials into the pipe.

B. Regardless of cause, damaged pipe shall be replaced with new products at the expense of the Contractor.

1.6 GRADE AND ALIGNMENT CONTROL

A. General

1. The necessary installation procedures that will ensure the pipes are installed at the location and grade staked in the field shall be used.

B. Method

1. One of the following methods shall be utilized to control grade and alignment: Batter boards set at 25' intervals with a string line set over at least three batter boards. Electronic "Laser" beam set at structure locations or grade breaks. At least three grade points shall be checked to verify the set grade. Survey instrument set at structure to site between structures at the set grade.

C. Equipment

1. The Contractor shall furnish all equipment necessary to install and inspect the pipe installation. Grade rod shall be held to a minimum in all cases.

PART 2 - PRODUCTS

2.1 STORM DRAIN PIPE

A. Pipes 12” in diameter or larger:

1. Type S High Density Polyethylene (HDPE) with smooth inner lining and corrugated outer wall, or

2. Reinforced Concrete Pipe (RCP), Class III unless otherwise shown on the plans, in conformance with ASTM C-76.

B. Pipes 10” in diameter or smaller:

1. Type S High Density Polyehtylene (HDPE) with smooth inner lining and corrugated outer wall, or

2. Polyvinyl Chloride Pipe (PVC), SDR 35, Series 46 with water tight couplings.

C. Storm drain 8-inch diameter and larger shall be either HDPE Type S, smooth interior wall, or Polyvinyl Chloride Pipe (PVC), SDR 35, Series 46.

D. Storm drain 6-inch diameter and smaller shall be polyvinyl chloride pipe (PVC), SDR 35.

E. Subdrain pipe shall be perforated Polyvinyl Chloride Pipe (PVC), SDR 35, Series 46.

F. HDPE plastic pipe shall conform to the requirements of Section 64 of the Caltrans Standard Specifications for Type S, smooth interior wall, and shall be furnished with water tight, gasketed couplings.

G. PVC pipe shall be have with water tight, gasketed couplings.

2.2 DRAINAGE STRUCTURES

A. Storm drain drop inlets (SDDI) shall be manufactured by Oldcastle Infrastructure with model indicated on the plans, or approved equals.

1. Grates shall be standard opening, standard duty, with bolt down feature in landscape areas.

2. Grates shall be ½" maximum opening (in direction of travel), heavy duty, and bolt down feature in pavement areas. Provide paving notch for inlets located in areas of asphalt paving.

B. Drainage inlets (SDDI) noted on the plan as "P6" or "P8" shall be as manufactured by Dura-Drain or approved equal, and shall be of the model/size indicated on the plans. Grates standard duty, with bolt down grates.

2.3 CLEANOUTS

A. Private Cleanouts shall comply with the details as shown on the Drawings. Cleanouts shall have concrete lids marked "storm drain".

PART 3 - EXECUTION

3.1 GENERAL

A. All construction of the storm drain shown on the offsite plans shall conform to the requirements of the (City, Town, County) Standards.

3.2 VERIFY EXISTING CONDITIONS

A. The exact location and depth of the existing storm drains is unknown and is shown based on the best information available.

B. Contractor shall pot hole in the vicinity of each connection point to existing facilities to verify the exact location and size of the existing storm drain. This information shall be presented in the form of a field sketch through the RFI process for review and confirmation by the Engineer that the line is adequate to serve the proposed project.

3.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Storm drain pipe shall be delivered, handled and stored in a way that prevents damage.

B. Regardless of the cause, damaged pipe shall be replaced by new products at the expense of the Contractor.

C. Precast structures shall be delivered, handled and stored in a way that prevents damage.

D. Installed precast structures structures shall be protected from damage.

E. Regardless of the cause, damaged structures shall be replaced by new products or repaired to the satisfaction of the Engineer at the expense of the Contractor.

3.4 STORM DRAIN PIPE

A. Trenching shall be as indicated in Section 31 2316, Trenching, Backfilling and Compaction.

B. Pipe laying shall be as indicated in paragraph 3.06 herein.

C. No pipe shall be installed which is cracked, damaged or otherwise unsuitable for use in the opinion of the Engineer.

3.5 STORM DRAINAGE STRUCTURES

A. Excavation and backfill shall conform to Section 31 2316, Trenching, Backfilling and Compaction.

B. Joints shall be made watertight. Any visible leaks shall be permanently plugged.

3.6 PIPE LAYING

A. No pipe shall be laid when trench conditions are unsuitable to allow performing the job in a workmanlike manner.

B. Where ground water occurs, pumping shall continue until backfilling has progressed to a sufficient height to prevent flotation of the pipe. Water shall be disposed of in such a manner as to cause no property damage or be a hazard to public health. In accordance with Section 31 2316, Trenching, Backfilling and Compaction.

C. Pipe shall be laid with bell ends facing in the direction of laying, and shall progress uphill.

D. Pipe deflections where permitted shall not exceed that recommended by the pipe manufacturer.

E. Every precaution shall be taken to prevent foreign material from entering the pipe. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. If foreign materials do enter the pipe, they shall be removed continuously as work progresses.

F. At times when pipe laying is not in progress, the open ends of laid pipe shall be closed by a water-tight plug.

3.7 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

B. Properly repair all surfaces disturbed by construction.

END OF SECTION